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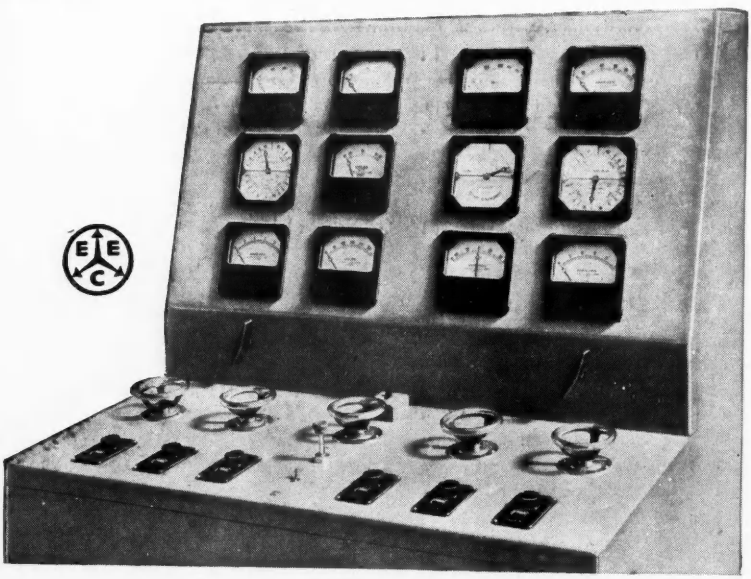
Instruments ...



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ELECTRICAL REVIEW

Vol. CXLIX No. 3841 6TH JULY, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Adequate Power

THE CAPITAL STRAIT JACKET

THE thoughtful and constructive presidential address by Sir Henry Self at the B.E.P. Convention at Brighton strides forward from the monumental paper he read at Harrogate last year. In the earlier paper it was apparent that he had applied a well-trained and versatile mind to new problems. It was interesting to old hands to observe how he dealt with those problems, new to him, but the stuff of everyday life to them: how, in short, he cleared his mind to meet the task of operating the new undertaking in which he plays so important a part.

Obstacles to Progress

It was evident then that he already regarded the capital strait jacket as one of the two chief obstacles to progress—the other being coal. His plain statement of this fact was unpalatable to some Ministers, but the matter is now so urgent that the important decision to put the Brighton address in the hands of all members of Parliament and before Government Departments was, as we have already noted, passed unanimously. Let us hope that the tinge of pessimism to which Mr. H. W. Bosworth owned when seconding Mr. T. F. Lister's motion will prove unwarranted.

It is shown that home power production is an indispensable pre-requisite to both rearmament and export; and obviously the production of power must be as free as possible from cuts, the cost of which the Minister of Fuel and Power has guessed to be between £8 and £10 million of industrial production. Rearmament, the vital necessity of which is admitted by all but extremists, obviously cannot be carried out without adequate, constantly available, power. History shows that it is a first instinct in this country to let the fighting services slide as soon as a war has been won; the need for building them up again in a hurry is now before us, for the third time in forty years.

Export Prices

Since we cannot produce at home all the food and raw materials needed (though many sources of raw materials are inadequately worked) the necessity to export has been constantly in the forefront of national thought. It will be recalled that for many years electrical manufactures were exported at very low prices, rendered possible only by support from the home market. Arguments in defence were supplied by comparisons drawn between export trade, railway excursion traffic, and the

effort to fill up the valleys of the lighting load in the early days of electricity supply. Recent statements by financial experts have suggested that the policy of subsidies hides the true cost of labour, so producing apparent costs which are too low. The figures quoted by Sir Henry Self show that our export prices are attractive. If they were at a higher level—if the £ were revalued—the same volume of exports would bring in a greater volume of imports. This would reduce manufacturing costs and it might be possible that some home selling prices would fall.

EXHAUSTION OF RESOURCES

In moving the second reading of the Ministry of Materials Bill last week the new Minister (Mr. R. R. Stokes) said that according to statisticians, at the present rate of consumption there was only fourteen years' supply of lead in the world and 21 years' supply of zinc. We are used to hearing prophecies of the exhaustion of resources but these are usually in terms of a century or more. To be told suddenly that there will be no lead in 1965 is alarming. The identity of the Minister's statisticians was not disclosed but we are assured by an authority upon whom we believe we can rely that the position is not anything like so bad as this. But although Mr. Stokes may have been unduly alarmist this does not invalidate his argument that there must be economy in the use of these (and other) metals.

EXPEDITING ESSENTIAL ORDERS

Under the measures announced by the Government last week for avoiding delay to defence and essential civilian orders a system of symbols will be used. In the case of defence requirements the letters " D.O." are to be applied and will be passed down through the contractors, sub-contractors, and so on. The scheme for civilian orders differs in that the symbol " P.T. " (Preferential Treatment) will be used only to cope with bottlenecks in the production of important manufactures—the fuel and power programmes and dollar and sterling exports are specifically mentioned. The question arises whether potential obstacles will be discerned in time to avoid production hindrances; also what will happen when the comparatively small amount set aside for the purpose (6–7 per cent) is exhausted. The arrangements are, however, intended only as a temporary measure pending the introduction of the full allocation schemes and statutory enforcement is not intended.

PRODUCTION PATTERN

The third of the series of O.E.E.C. reports on the European Recovery Programme comes at a time when problems rather than progress seem to be the order of the day. The doubtful prospect, however, should not obscure the very substantial achievements of the past few years. The report refers to the " spectacular " increase in output per man-hour in the United Kingdom. Indices of production in Western Europe for 1950 show that compared with pre-war the most marked increases have been in refined oil products (200 per cent) and electricity output (80 per cent), while there has been considerable expansion also in the mechanical and electrical engineering industries (40 per cent). Coal production, however, has remained below the 1938 level. It is observed that member countries have been somewhat better able to provide for the rapidly increasing consumption of electricity but the general position is likely to be often critical until planned capacity is supplemented.

OVERTAXED " ELECTRICS "

One industry which is severely handicapped by heavy purchase tax is the manufacture of electric vehicles, and probably no other industry has a better case for relief from the tax. But although the justice of the vehicle makers' claim for relief (voiced through the Electric Vehicle Association) has been recognized by Ministers little has been achieved. It is true that last year the Chancellor relented to the extent of exempting pedestrian controlled vehicles and the bodies of other types, but still the tax on a 20 cwt " electric " is £136 while that on an equivalent petrol-driven van is only £97. In quoting this case at the Association's annual luncheon, Mr. Peter Rochs (chairman) asked where the sense or justice were. These two attributes are lacking in a good many applications of the tax. Maybe the advisory committee which the Government proposes to set up will attempt to introduce them.

British Instrument Industry

First National Exhibition at Olympia

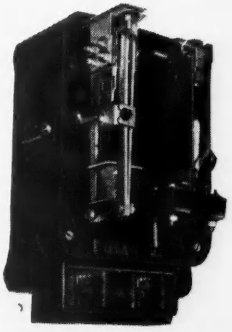
MORE than one hundred and fifty of the leading instrument manufacturers are displaying their products at the British Instrument Industries Exhibition now being held at Olympia, London (4th–14th July). This is the first exhibition to be devoted exclusively to the British instrument industry and its purpose is to acquaint instrument users in industry, medicine and education with the latest trends in British equipment.

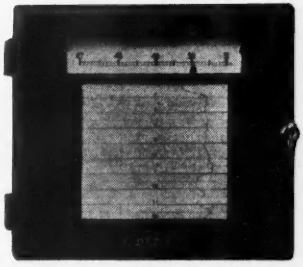
As it coincides with the Festival of Britain the exhibition provides an additional opportunity of demonstrating to the world the excellence of British production in a field linked closely with maximum production efficiency. The exhibition is being staged with the patronage and active support of the British Electrical and Allied Manufacturers' Association, the British Industrial Measuring and Control Apparatus Manufacturers' Association, the British Lampblown Scientific Glassware Manufacturers' Association, the Drawing Office Material Manufacturers' and Dealers' Association and the Scientific Instrument Manufacturers' Association of Great Britain.

Many instruments designed for use in specialized research can be used in other branches of research and also in industry. Some thirty instruments developed in the research establishments of the D.S.I.R. are demonstrated. They include mechanical, optical, hydraulic and electronic instruments designed to meet special requirements. Certain of these instruments offer possibilities of wider usefulness than those provided by the research for which they were first produced and are available for marketing by any interested manufacturer.

Load control is prominent nowadays. The thermally operated automatic maximum demand regulator shown by Sunvic Controls, Ltd., has been developed to meet this demand. It can be applied in many ways and it ensures that the necessary load reduction is carried automatically by a large number of consumers each making a small and non-critical contribution. For example, when the installation includes a water heater and the load other than that of the heater exceeds 6 kW the water heater will be disconnected. When the other load exceeds 3 kW, but not 6 kW, the power available for water heating will be inversely proportional to the value of this load.

An allied range of devices is shown by the Electrical Apparatus Co., Ltd. These peak load controllers (illus.) incorporate a discriminator which operates on either a change of frequency or voltage. In addition, it takes into account the





E.A.C. peak load controller and (*below*) Kent "Multelec" frequency recorder

consumer's actual load so that the greater the consumption during peak periods the smaller the voltage or frequency deviation necessary to bring the load limiting feature into play. Essentially, these devices limit the consumer's load to a predetermined value when there is a sustained drop in frequency or voltage. The same company is also showing a wide range of moving coil and moving iron instruments, frequency meters and moving coil relays together with specialized test gear and protective equipment. Protective relays for polyphase motors are shown by the P. & B. Engineering Co., Ltd., together with all types of thermal maximum demand and load indicators.

Steam measurements are dealt with by George Kent, Ltd., whose main exhibit is a larger boiler panel representing a typical example of instrumentation in this field. Among the supplementary exhibits is a working model of a new oxygen recorder, a superheat temperature controller and one of the new " Multelec " frequency recorders (illus. p. 3).

In the same field of activity Bailey Meters & Controls, Ltd., are showing instrument panels, indicators, recorders and automatic controllers as used in the control of boilers and industrial processes such as steel-making. In similar vein British Arca Regulators, Ltd., are displaying automatic control devices including thermostats, humidistats and motor-operated steam valve units. A full range of combustion and boiler control equipment is exhibited by James Gordon & Co., Ltd.

Industrial control instruments are also shown by Foxboro-Yoxall, Ltd. These comprise indicators, recorders, controllers and transmitters for temperature, humidity, pressure, vacuum, liquid level, flow and specific gravity. A feature of the stand is the new range of " Consotrol " miniature

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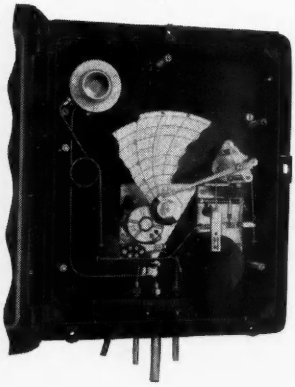

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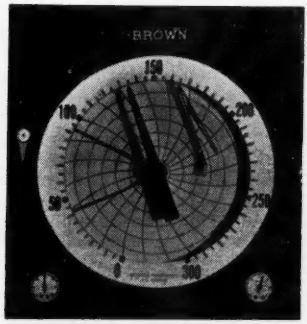

(1) Negretti & Zambra servo-operated positioning mechanism incorporated in a recorder. (2) Honeywell - Brown potentiometer pyrometer. (3) Elliott a.c./d.c. comparator. (4) Short & Mason " Transet " recorder

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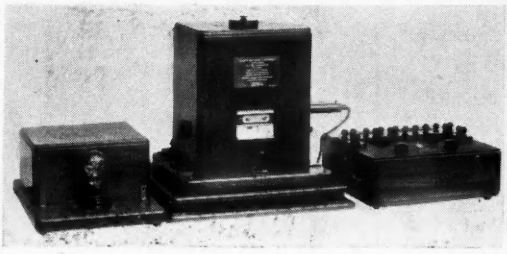

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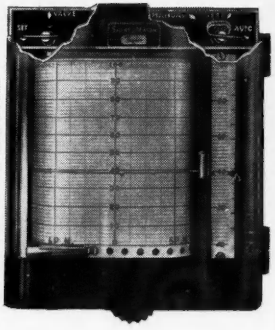


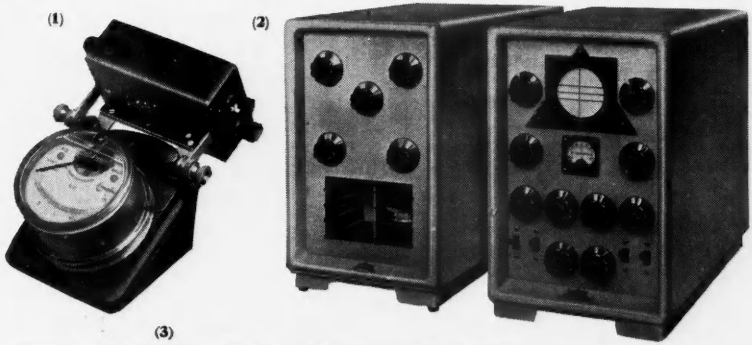
ntrol instruments. This equipment has een designed for use in the graphic or line iagram representation of process operation ut it may also be mounted on the more onventional type of instrument panel with onsiderable saving in space.

The needs of the fuel conversion industries re also covered by the exhibits of Alexander Wright & Co., Ltd., which include equipment for determining calorific value, pecific gravity and other factors relevant o gas manufacture by coal carbonization r by oil distillation and conversion. Apart from pressure and vacuum gauges nd indicating and recording instruments here is a photometer bench and integrating sphere, with a " Lummer-Brodhun " photometer head and the " Simmance " flicker photometer head.

The main exhibit of Short & Mason is a graphic panel, embodying the new series of " Transet " recording and indicating receivers (illus.), which occupy a panel space of only 4⅜in by 5in; they have built-in auto-manual controls and roll type charts. In addition there is a comprehensive range of indicating, recording and controlling instruments for temperature, pressure, flow, liquid level, humidity and specific gravity. Other industrial instruments are shown by Ether, Ltd., and the Electroflo Meters Co., Ltd. Elliott Brothers (London), Ltd., have a wide range of indicating and recording instruments and electrical laboratory equipment and test sets, the latter including a particularly interesting a.c./d.c. comparator for precise a.c. measurements by reference to a d.c. potentiometer (illus.).

On the stand of Negretti & Zambra, Ltd., is a comprehensive range of industrial instruments for indicating, recording and controlling temperature, pressure, humidity, volume and flow together with meteorological and aircraft instruments. Among the pressure, differential, draught and contents gauges is an interesting new servo-operated positioning mechanism for indicating, recording and controlling low pressures down to 0·2in water gauge (illus.).

The main feature on the stand of Evershed & Vignoles, Ltd., is a display of operations recorders. These automatically plot on a single chart a " two position " record showing on a time basis the frequency and duration of any operation it is desired to study. Both the multi-pen type having roll charts and the single-pen type with drum charts are demonstrated.



(1) Crompton Parkinson educational instrument with rectifier unit. (2) Unicam spectrocomparator. (3) Taylor, Taylor & Hobson Model 3 " Talysurf "

By replacing the conventional galvanometer and cyclic balancing mechanisms with a simple self-contained amplifier assembly the potentiometers shown by Honeywell-Brown, Ltd., provide continuous balance with high sensitivity and simplified and rugged construction. The models on view consist of a circular chart recorder controller with three-term pneumatic control, a multi-point precision indicator with integrally mounted thermocouple switches, single- and multi-point strip chart recorders (2 sec and 5 sec), a circular scale indicating electric proportional controller with manual reset, and recorders for liquid steel temperatures and radiation pyrometers (illus. p. 4).

An interesting electronic instrument shown by Fielden (Electronics), Ltd., is a proximity meter (illus. p. 7) for use in micromeasurement. With a suitable electrode assembly it is easily possible to detect displacements of 0·00001in. It operates by measuring changes in capacitance and so does not require actual contact with the object being investigated.

The electronic apparatus shown by Elcontrol, Ltd., includes " on-off " or two-position controllers, designed particularly for industrial as distinct from laboratory use. There is liquid level control equipment, gas and oil fired furnace protective gear, a wide range of process timers, photoelectric control apparatus and temperature control equipment, to name but a few. A wide range of industrial electronic apparatus is also shown by Kelvin & Hughes (Industrial), Ltd.

Besides an electrocardiograph and a television alignment and pattern generator A. C. Cossor, Ltd., are showing their model 1035 flat screen double beam oscillograph (illus. p. 7). This has two independent amplifiers having frequency ranges from 20 c/s to 7 Mc/s and 20 c/s to 100 kc/s respectively. Voltages and time intervals can be measured on either beam and the time base is arranged to provide a repetitive, triggered, or single-stroke scan with a velocity of from 150 millisec to 15 microsec.

Amongst the latest electronic equipment shown by Wayne Kerr Laboratories, Ltd., is an audio-frequency waveform analyser (illus.) covering 50 c/s to 20 kc/s in two ranges. Relative voltage levels of the component frequencies of a complex input waveform are measured directly in decibels down to -55 db with an accuracy of ± 1 db or down to -65 db with an accuracy of ± 2 db at any fundamental input level between -20 db and $+20$ db relative to 1 mW into 600 ohms.

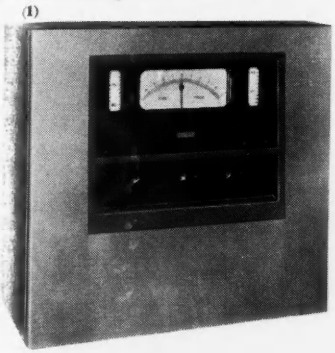
Electronic equipment is also shown by Southern Instruments, Ltd., who display an oscillograph (illus. p. 7) for recording transient surges from impulse generators and in high voltage circuits with the aid of a 10 kV sealed off cathode-ray tube. The total voltage range which can be recorded is about 600 V. High-voltage surges to be recorded are applied through resistance or capacity voltage dividers, but these are not included in the equipment. The time-base speed range is from one microsec to one millisec for full screen deflection and a wave-front rise in 0·01 microsec can be recorded.

Among the recently developed electronic instruments shown by E. K. Cole, Ltd., is an industrial thickness gauge (illus.) in which the degree of absorption of radiation from a radioactive source is used to provide an accurate measurement of thickness. As no contact is made with the sample a wide variety of materials can be measured including soft materials and wet or sticky coatings. A new scintillation counter is also shown working with a ratemeter, while another demonstration shows the scintillation counter working with a scaler and power unit. Scintillation counters and allied equipment are also being displayed by Nucleonic & Radiological Developments, Ltd.

Mullard, Ltd., is also exhibiting a wide range of electronic products which, apart from valves themselves, are divided into four groups: electronic test equipment, electro-chemical equipment, ultrasonic equipment and vibration equipment. Similar large and varied selections of electronic apparatus are displayed by Cinema-Television, Ltd., Airmec Laboratories, Ltd., Electronic Instruments, Ltd., and 20th Century Electronics, Ltd.

An interesting electronically controlled device shown by Apis Engineering and Research, Ltd., is a liquid dispenser which handles volumes between ·5 ml and 50 ml. It is controlled by photoelectric cells, is speedy, accurate, non-drip and easy to sterilize in an autoclave.

A waveform analyser, shown by Muirhead & Co., Ltd., and known as the Muirhead-Pametrada equipment (illus. p. 7), has been designed primarily for the analysis of complex vibration waveforms, but is equally



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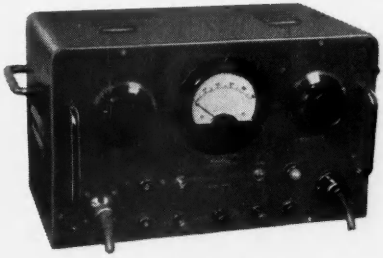

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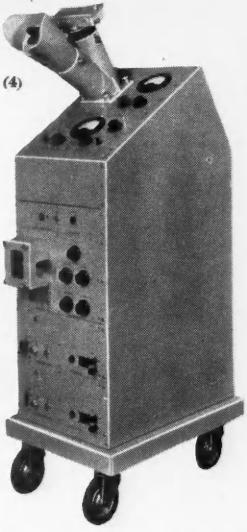

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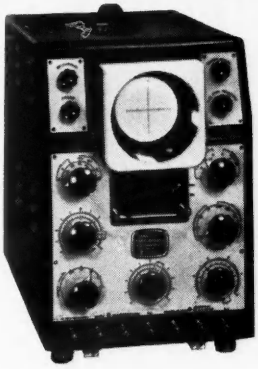

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(1) E. K. Cole industrial thickness gauge
(2) Wayne Kerr a.f. waveform analyser
(3) Fielden proximity meter
(4) Southern Instruments 10 kV transient recorder
(5) Muirhead-Pametrada wave analyser
(6) Cossor double - beam oscillograph

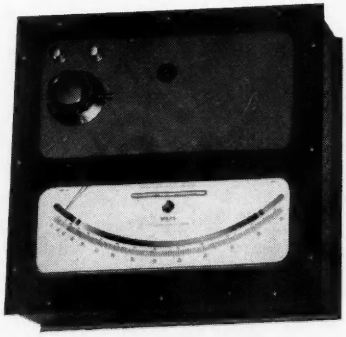
applicable to the measurement of audio- and power-frequency waveforms up to 21 kc/s. The same company is also showing a permanent magnet d.c. machine which can be used as a motor, generator or tachometer-generator.

An interesting spectrocomparator shown by Unicam Instruments (Cambridge), Ltd. (illus. p. 5) combines repeated scanning of a given spectral region, at a frequency sufficiently high for presentation on a cathode-ray screen, with a system by which the difference between the absorption spectra of two samples is displayed. It is arranged in two units of equal size, one containing the light source, double beam optical switching system and absorption cells, monochromator with scanning mechanism, radiation detector and head amplifier; and the other the power supplies and cathode-ray tube display system.

The model 3 "Talysurf" contour tracing equipment of Taylor, Taylor & Hobson, Ltd. (illus. p. 5) is a lower-priced development of model 2 for general industrial use. It provides both a graph and an average reading and incorporates an inkless pen recorder, which provides a graph having rectilinear co-ordinates, that is, one in which the ordinates are straight and at the same time the scale is linear. A useful accessory has also been introduced for obtaining a curved datum, convex or concave, over a continuous range from $\frac{1}{8}$in to 2in radius.

Apart from house service meters and switchboard and portable instruments, Crompton Parkinson, Ltd., are showing the new "Alltest" meter which can be used as a milliammeter, resistance measure, millivoltmeter, ammeter and voltmeter. It is inherently a d.c. instrument which can be given an almost unlimited range by the use of shunt and bobbin attachments. To provide for a.c. testing in addition, a Westinghouse metal rectifier attachment is available which comprises the rectifier and resistances enclosed in a black moulded case fitted with two connection prongs (illus. p. 5).

A representative range of Sangamo Weston electrical instruments is on show; it includes laboratory standards (illus.), portable instruments, multi-range test sets, galvanometers, switchboard instruments and a representative range of meters, metering accessories and time switches. Apart from various types of precision instruments, the Sifam Electrical Instrument Co., Ltd., is showing timers, decade resistance boxes and portable instruments including quick response pyrometers (illus.) with ranges of 200 and 400 deg C. Like Nalder Bros. & Thompson, Ltd., Ernest Turner Electrical Instruments, Ltd., and Victoria Instruments are mainly showing panel mounting instruments. Others of this kind are shown by Measuring Instruments (Pullin), Ltd., and Everett, Edgcumbe & Co., Ltd., who are also displaying process



Above: **Sangamo Weston laboratory standard voltmeter.** *Left:* **Sifam quick response temperature indicator**

timing controls. The Automatic Coil Winder & Electrical Equipment Co., Ltd., is showing its range of "Avo" multi-range test meters.

The representative range of instruments shown by the Record Electrical Co., Ltd., includes the "Cirscale" type, the moving-coil model of which has recently been redesigned, with an improved magnet system giving greater sensitivity. Other exhibits of this company are tachometers and portable test sets.

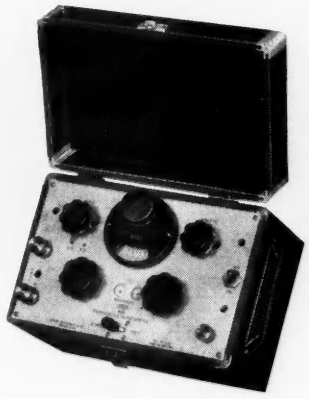
The exhibits of the English Electric Co., Ltd., include two switchgear cabinets fitted with a comprehensive range of panel-mounting instruments comprising ammeters, voltmeters, power factor indicators and indicating wavemeters. In addition there is a working demonstration of a portable d.c. insulation tester, an electronic process timer, a photo-cell unit and an electronic switch. The stand is shared by Marconi Instruments, Ltd., who give an effective answer to communication measurement problems in their extensive display of signal generators, frequency measuring equipment, waveform analysers, Q meters, and radio-frequency bridges.

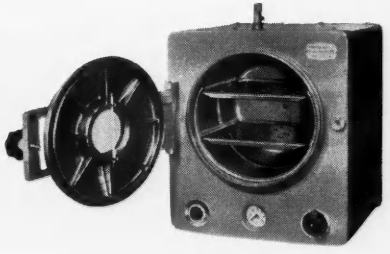
The usual comprehensive range of precision measuring equipment is to be seen on the stand of the Cambridge Instrument Co., Ltd., which has a background formed of a series of instrument panels showing typical arrangements of industrial instruments (chiefly temperature indicators and recorders), while a variety of electrical and mechanical instruments is displayed in illuminated showcases.

The selection of precision instruments shown by the Doran Instrument Co., Ltd., includes a self-contained d.c. potentiometer covering direct measurements from 1 μV to 1·8 V in three ranges, a thermo-couple potentiometer of miniature construction (illus.) and pH meters with a guaranteed accuracy of 0·01 pH.

The main feature of the Ferranti, Ltd. stand is a large panel showing a comprehensive range of flush mounting instruments from 2in to 8in dial, both round and square types, and including hermetically sealed instruments for use under severe tropical conditions. Apart from electrostatic phasing equipment and a typical summation metering panel a demonstration is being given of the "Servopack" line following equipment.

The Metropolitan-Vickers display includes the "Metroflux" probe magnetometer and the "Varimag" permeameter which is used for the routine testing of magnet steels for remanence, coercivity, maximum energy and recoil data, and also for tests on ferrous materials of low and medium permeability. Apart from an electron diffraction camera and samples of "Metrosil" there is a miniature oscilloscope which has a performance equal to that of a full-size cathode-ray oscilloscope, but a front panel little larger than a postcard, and a universal meter for the usual current,





Above: **Townson & Mercer standardized vacuum oven.** *Left:* **Doran miniature thermocouple potentiometer**

resistance and voltage measurements, and also radio-frequency voltage measurements.

In addition to a wide range of time switches, Venner Time Switches, Ltd., are exhibiting some of the instruments they make to meet special requirements. These include a contour projector for accurate and rapid checking of small parts, several types of gauges for repetition work, and an electrically controlled stop-watch. An associated company, Venner Accumulators, Ltd., is showing a range of lightweight alkaline accumulators, based on the silver-zinc reaction. These cells have a high power-to-weight ratio, are capable of high rates of discharge and are unaffected by shock.

The exhibits of the General Electric Co., Ltd., include a comprehensive display of switchboard and portable indicating instruments in all grades and sizes, together with link testing instruments and a magnetic sorting bridge with special presentation on a large cathode-ray tube. An associated company, Salford Electrical Instruments, Ltd., shows quartz crystals for radio uses and quartz crystal activity test sets, selenium and copper oxide rectifiers, toroidal and "Gecalloy" iron dust cores, remote indication and control equipment, and apparatus for use in connection with radioactivity.

Instruments for measuring X-rays and other ionizing radiations occupy the stand of the Baldwin Instrument Co., Ltd., and these are supplemented by photometric instruments and amplifiers and general laboratory and industrial instruments.

Selenium photo-cells of all kinds are shown by Megatron, Ltd., as well as special instruments in which they are employed. Similar equipment displayed by Evans Electroselenium includes a reflectance spectrophotometer, an opacimeter, a portable colorimeter and a colour temperature meter.

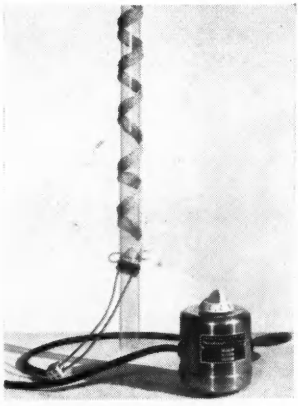
One of the most important fields of application of scientific instruments is in education, and comprehensive collections of this type of apparatus are shown by such firms as A. Gallenkamp & Co., Ltd., W. & J. George & Becker, Ltd., Baird & Tatlock (London), Ltd., and Griffin & Tatlock, Ltd. Besides similar apparatus, Townson & Mercer, Ltd., have on view two new silent shakers, one having built-in stroboscopic speed control, together with a new vacuum oven of standard size (11in deep by 10in diameter) which has cheapened production (illus. p. 9).

Educational apparatus is also displayed by W. Edwards & Co. (London), Ltd., as well as a good selection of high vacuum apparatus.

A comprehensive selection of equipment for temperature measurement and control and also "Introscopes" for internal examinations are exhibited by the Foster Instrument Co., Ltd. The equipment shown covers the entire field of temperatures likely to be encountered in industrial or research work and includes single- and multi-point temperature indicators and recorders for use with both thermocouple and resistance thermometer elements, automatic temperature controllers and optical and radiation pyrometers for temperatures up to 3,000 deg C.

Among the range of laboratory heating equipment shown by Electrothermal Engineering, Ltd., particular attention is drawn to the flexible heating mantles and heating tapes (illus.). The surface loading of the latter is about 2·5 W/sq in, enabling temperatures of 400 deg C and over to be reached inside a glass tube of 2 mm wall thickness.

The stand of Murex, Ltd., is confined to components used in the construction of instruments including samples of several materials which are now being produced in this country, such as zirconium and tantalum. Apart from sintered permanent magnets, tungsten and molybdenum metals



Electrothermal heating tape and controller

are being shown in forms which could not previously be supplied. Both these metals are being increasingly used for high temperature work. Metals for use in instruments also forms the subject of the exhibit of the Telegraph Construction & Maintenance Co., Ltd. There are magnetic alloys, resistance alloys, thermostatic bi-metals and alloys with controlled thermal expansion together with beryllium copper and special purpose nickel-iron alloys.

The detection of flaws in metals is now a well-established technique. The equipment shown by Glass Developments, Ltd., for this purpose is portable and can easily be adapted for use with varying lengths of specimen to give a full picture on the 6in cathode-ray tube. The probes are light and easy to handle and a simple mechanical link to the unit provides the synchronism between the movement of the probes and the picture.

Electric Vehicle Association

Past Year's Activities

ABOUT 170 members and guests of the Electric Vehicle Association met at the annual luncheon of the Association at the Connaught Rooms, London, W.C.2, on 27th June. Mr. Peter Rochs, chairman, presided in the absence through ill-health of Sir John Kennedy, the president.

Mr. G. R. Strauss, Minister of Supply, was the principal guest and proposed the toast of the Association. In the course of his remarks, Mr. Strauss said that the industry continued to do well in spite of the difficulties it was encountering. Although production was greater than before the war the industry found it hard to increase the number of electric vehicles on the roads. One reason was the high purchase tax but although there were good arguments for relief the Chancellor of the Exchequer was unable to grant it. It could at least be said that the tax had not been increased by this year's Budget.

After enumerating the advantages possessed by the "electric," Mr. Strauss said that the shortage of materials was likely to prevail for some time but his Ministry was doing what it could to secure greater supplies. The situation seemed a little brighter than it did some time ago but the supply of most metals was found to be below requirements. Manufacturers must try to find substitutes and save metal where possible.

In replying to the toast Mr. Rochs reviewed the attempts made last year by the Association to secure the removal of the burden of purchase tax, the only result of which was relief for one section of the industry—a distinction between two groups of manufacturers which was iniquitous and absurd.

They had secured the approbation of Lord Citrine, the Minister of Fuel and Power, Lord Hurcomb and Mr. Alfred Barnes (Minister of Transport) but even with this support the Association could not influence the Chancellor of the Exchequer. Their representatives had had an interview with a senior Treasury official but although he was evidently impressed by their arguments no reference at all had been made to their problem in Mr. Gaitskell's Budget speech.

There was no fear that the motor manufacturers would object to the relief of the electric vehicle from purchase tax and in any event there was already discrimination between two sections of their own

Mr. G. R. Strauss speaking at the E.V.A. luncheon. On his left is Mr. Peter Rochs, chairman of the Association

industry. The amount collected did not justify the expense of collecting it. Did the Chancellor know that the tax on a 10 cwt electric vehicle was 74 per cent more than on a 10 cwt petrol vehicle?

The Association must continue to fight for just treatment and they hoped that they would have Mr. Strauss's support.

Mr. H. V. Schofield (Chloride Batteries, Ltd.), proposing the toast of " The Electric Vehicle User," said that too much time was being taken in planning schemes and bringing them to fruition. In the course of further remarks he stressed that the industry could not get on with rearmament until the B.E.A. was put into a position to give a sufficient and uninterrupted supply.

Mr. W. A. Nell (chairman and managing director, Express Dairy Co.) replied to the toast. He said that half of his company's 3,000 vehicles were electrically propelled and two-thirds of these were of the pedestrian-operated type. They considered petrol vehicles unsuitable for their work; they still used horses but they would gradually be eliminated in favour of electric vehicles. The heavy capital outlay on large vehicles was a drawback and he agreed that the purchase tax was iniquitous especially when it added to the costs of distributing food. He thanked the manufacturers for their service but said that they had not yet produced the ideal vehicle.

ANNUAL REPORT

THE report for 1950 shows that there was a net increase in membership of three firms. In addition to the Executive and Finance Committee there are a Vehicle Manufacturers' Committee, a Publicity and Exhibitions Committee and five sub-committees, panels or delegations for negotiations with the G.P.O., approach to the Government upon the use of electric vehicles, organization, road tests and purchase tax.

Full details are given in the report of the action taken by the Association in its endeavour to secure relief from purchase tax. While complete success was not achieved it is recorded with satisfaction that exemption was secured for batteries and pedestrian controlled vehicles and bodies of other vehicles.

New electric vehicle registrations at 31st December, 1950, totalled 3,526, including 1,124 pedestrian operated " prams " and 321 invalid vehicles. The largest numbers of registrations of other vehicles were in the 12 cwt to 1½ ton classes (1,543). Ten vehicles of between 3 and 5½ tons were registered.

The approximate number of electric vehicles in use rose fom 22,030 in 1949 to 25,235 in 1950, of which pedestrian controlled types accounted for 6,498 and 7,622 respectively.

Turkish Power Scheme

THE June *Monthly Trade Journal* of the British Chamber of Commerce in Turkey reports that on 18th May the director-general of the Eti Bank, Bay Cemil Gokçen (formerly Director of the Electrical Study Department of the Turkish Ministry of Public Works), began to examine and compare the first bids for the Sariyar hydro-electric station. This station, the cost of which is tentatively put at £T140 million (£17·5 million sterling, nominal), will be the largest single enterprise of its kind hitherto undertaken in Turkey. The scheme covers the construction of a dam and hydro-electric station on the Sakarya river with two 65,000 h.p. turbo-generators. It is intended that the new station shall provide cheap industrial power by a grid system to central and western Turkey.

The *Journal* says : " For the past five years the representatives of all major engineering companies have maintained a careful watching brief on this project. The issue will presumably be fought out between British, U.S. and German companies but it is understood that other Continental competitors will be quoting. . . . Companies have been asked to quote on the basis of their particular specialization. It remains to be seen whether Britain, having built the Karabuk Steel Works and subsequently the Catalagzi power station can now pull off a ' hat trick ' by securing a major portion of Sariyar." The consulting engineers for the scheme are a Boston (U.S.A.) firm.

Another subject of international competition is the electrification of the Sirkeci-Kuçuk-Cekmece suburban line of the Turkish State Railways. It is not yet certain how the scheme will be financed but it has the support of the Government and the Istanbul Municipality. It is likely that credit terms will be expected of would-be tenderers.

Miners' Pensions

A GREEMENT was reached in London on 27th June between the National Coal Board and representatives of the National Union of Mineworkers on the outline of a contributory scheme of pensions for mineworkers.

Illumination Technique

Twelfth Session of International Commission Opens in Stockholm

By G. F. COLE

THE twelfth session of the International Commission on Illumination opened in Stockholm on 27th June in the presence of King Gustav of Sweden, who has graciously given his patronage to this meeting of the Commission. The opening plenary session was held in the Concert Hall; the technical meetings are taking place at the Stockholm Institute of Technology.

The meeting is being attended by representatives from twenty-two countries including Great Britain, the United States, France, Belgium, Germany, Holland, Denmark, Norway, Italy and Switzerland. The largest delegation from overseas is that from Great Britain, whose seventy delegates are under the leadership of Dr. S. English. Dr. J. W. T. Walsh, who is chairman of the National Illumination Committee of Great Britain, is a vice-president of the Commission and has other duties to carry out. The total number of delegates from all countries is 393, many of whom are accompanied by their wives.

The Commission normally meets every three years, the last meeting having been in Paris in 1948. It is understood that the Commission is considering the possibility of extending the period between meetings to four, or even five, years as it is felt that a three-year interval is not sufficient for the work on some subjects to be carried out and reported properly.

Commission's Objects

The objects of the Commission are to provide an international forum on all matters relating to the art and science of illumination, to promote the study of lighting matters, to provide for the interchange of information between countries and to agree upon and publish international recommendations. The Commission has no mandatory powers and such recommendations as it makes from time to time (e.g., on airfield lighting, or automobile headlamps) are put by the individual national committees to their own national bodies responsible for such matters in an effort to have the recommendations of the Commission adopted by as many countries as possible.

The work of the Commission is based on the activities of the national committees of the various member countries. The Commission has a number of more or less permanent subjects, such as photometry, light sources and the various applications of light, before it and its practice is to appoint various countries as secretariats for the different subjects. The secretariat committees collect information on their particular subjects from all the other member countries and present reports on progress at the meetings of the Commission where the reports are discussed. Papers are also read at the meetings and it is noteworthy that of the forty-three papers to be presented at Stockholm ten are by authors from Great Britain.

Opening Session

At the opening session the chair was first taken by Mr. W. Borgquist, the president of the Swedish Central Committee for International Engineering Congresses. He welcomed the delegates to Sweden, saying how much the northern countries, where the winters were long, depended on artificial lighting. He was followed by Mr. T. Nilsson, Minister of Communications, who pointed out that lighting was cheap in Sweden on account of the abundance of water power. He said that 96 per cent of homes in Sweden had electric light and it was hoped that the remaining few would be so equipped within the next few years. Mr. Ivar Folcker, chairman of the Swedish National Illumination Committee, recalled the growth of the Commission during the last fifty years.

The chair was then taken by Dr. Halbertsma, president of the Commission, who

introduced the officers of the Commission to King Gustav.

The opening session concluded with two papers, one on "Light and Human Life" by Prof. Theorell and the other by Dr. D. B. Judd, who spoke on "Seeing, Light and Colour."

One of the matters to come up for discussion is the colour and colour-rendering properties of fluorescent lamps. There are at present a number of what might be called "white" fluorescent lamps; each country has its own range of colours and similar names in different countries do not necessarily imply the same colour of lamp. It is to be suggested that data on the colour and colour-rendering properties of fluorescent lamps shall be collected in all countries, using the method of measurement agreed by the Commission at the 1948 meeting. Such data would be of great help in considering the possibilities of rationalizing colours and the inclusion of colour and colour-rendering in lamp specifications. At the moment there are certain trends which are governed to some extent by the limitations of existing phosphors; in this connection it is interesting to note that the calcium halo-phosphates developed in Britain are now being used in the United States and on the Continent and are superseding the mixtures of phosphors originally used to produce the range of "white" lamps.

The possibility of international rules for traffic signals will be discussed and work which has been going on for some time on the colours of light signals (road, railway, aviation and marine) will be reported and a number of recommendations are expected.

"Brightness Engineering"

Lighting practice covers most fields of illumination and a number of technical sessions have been allocated for the discussion of the secretariat report and the presentation of papers. It will probably be under this subject heading that discussion will take place on "brightness engineering," an aspect of lighting which is becoming popular, especially in the United States. Much work has been done on this subject and a variety of papers has been published, but it is doubtful whether the average lighting engineer is very clear about what it all means; and it is hardly to be wondered at considering the mass of figures and formulæ which have been produced. Perhaps something useful will come out of the Stockholm meeting. It is understood that Dr. Hopkinson, who has been working on the subject at the Building Research Station, is endeavouring to take advantage of the presence in Stockholm of a number of the experts on the subject to arrange for points of difference to be discussed.

The secretariat report on street lighting, always a popular subject, has been prepared by the United States. Information for inclusion in the report was collected by means of a questionnaire which was sent to at least eight countries. Considering the lead which has been given by Great Britain in street lighting matters the report hardly does justice to our efforts. Reference is made in the report to the evidence produced in the United States to show that street accidents by night are reduced by improved street lighting; this question was debated in 1948 when representatives from other countries stated that similar tests in their own countries had produced rather indefinite results due to the many other factors which are involved.

New Research Buildings

THE Simon Engineering Group's new research and development buildings were formally opened on Tuesday by Sir Henry Tizard, chairman of the Advisory Council on Scientific Policy, at a luncheon attended by over 300 guests.

Proposing the toast of "The Guests," Lord Simon of Wythenshawe said that if they were to go on competing successfully with the world's foremost industrial nations they must tackle research and development on a new scale. That was one of the main reasons why they have spent £250,000 on the new buildings and equipment. In the past five or six years they had achieved about £25 million of exports to about forty countries and their present order book of over £50 million included power station contracts in Australia and the Middle East valued at about £6 million. They also had a heavy programme at home in building power stations for the British Electricity Authority, coal cleaning plants for the National Coal Board, coke ovens for new steelworks like Margam and Shotton, and many sulphuric acid plants. He hoped that concerns like the National Coal Board and the British Electricity Authority would not be tempted to design and build their own plants, which would deprive the company of much of the home market which was such an essential foundation for export business.

"White" Fluorescent Lamps

Development for Social and Recreational Purposes

By A. H. McKEAG, M.SC., A.R.I.C.*
and E. E. MILES, B.SC., A.INST.P.*

EARLY last year a new fluorescent lamp colour known as "mellow" was introduced in this country for restaurant, domestic and general social lighting. To appreciate the main factors which determined the final choice of colour for these purposes, let us consider the more important characteristics of the fluorescent materials used to produce the new colour.

It is common experience that for social lighting a "warm" source is desired. That is to say, the light should be richer in orange and red light and deficient in blue light, compared with normal daylight. Not only should the source for social lighting be rich in deep red, but its appearance must also create the impression of warmth. Even the light from an ordinary tungsten filament lamp, which is much warmer than daylight, is too cold for many social purposes. For this reason the fairly general practice in domestic and restaurant lighting is to increase the warmth of tungsten filament lamp lighting by the use of tinted shades, or fittings, and by suitably tinting the ceilings and walls. The resultant light is warmer simply because of the absorption of blue and blue-green light by the tinted surrounding materials. This subtractive method of producing a warm light necessarily means that the effective efficiency of the source is reduced. In practice, reductions of 50 per cent or more are quite usual with tinted fittings.

Improved Efficiency

When, however, fluorescent lamps are used, warm light can be produced directly by the use of suitable fluorescent materials. A further advantage is that light of a quality acceptable for social and domestic interiors can be produced at an efficiency perhaps five or six times that of the equivalent filament lamp/filter combination.

It is extremely difficult to specify the ideal "warm" light since the choice depends not only on the purpose for which the light is required, but also on such factors as the furnishing and decoration of the interior in question; personal taste is also an important contributory factor.

The subtractive method of producing warm light has the one advantage that a wide range of spectral energy distributions can readily be obtained simply by varying the absorptive characteristic of the fitting. The spectral composition of the resultant light is, in general, not far removed from that of a tungsten filament lamp operating at an appropriately lower temperature. Increasing the warmth of the source produces a greater distortion in the colour-rendering properties of the light, but long usage has made such distortion acceptable.

Blending of Powders

In fluorescent lamps, on the contrary, modifications of the spectral composition of the light are not usually made by the subtractive filter method, but by suitably selecting or blending the fluorescent powders used. For example, to obtain a resultant warm light from a given white fluorescent coating mixture, it is necessary to reduce the quantity of the blue fluorescing constituent of the internal coating of the lamp while increasing the amount of the orange and red. Since the intrinsic efficiency of fluorescent lamps is high and loss of energy is not caused by the presence of absorbing filters, this additive method gives a warm light at high efficiency.

One difficulty which arises is due to the fact that as the blue fluorescing constituent of the coating is reduced to make the light warmer, the effect of the blue and purple lines from the mercury discharge becomes more marked. The resultant colour-rendering distortion in the blue region is probably not greater than with warm tungsten lamp light. It is nevertheless different in that blues tend towards purple

* Research Laboratories, General Electric Co., Ltd., Wembley, England.

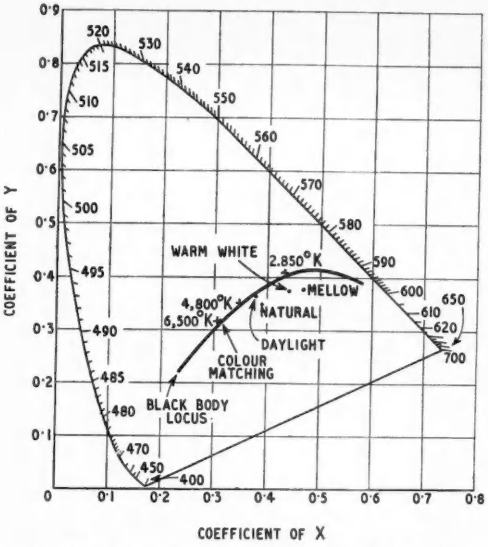


Figure 1.—I.C.I. chromaticity diagram showing the locus of spectral colours from 4,000-7,000A.U. and the locus of light from a temperature radiator at various temperatures

rather than towards the dark green or black obtained under tungsten light, and this effect is likely to cause comment until it becomes established through use.

In general, there is a relationship between colour-rendering characteristics and colour appearance, particularly when dealing with so-called temperature radiators such as tungsten lamps. It should, however, be borne in mind that it is possible to have two fluorescent light sources with closely similar colour appearances but having quite widely different colour-rendering properties.

A further matter which is relevant to the present discussion is that, even when the fluorescent source is adjusted to give the desired warm colour rendering, the overall appearance of the lamp may give rise to comment. This is particularly likely when the fluorescent lamps are seen in close proximity to tungsten filament sources.

During the past few years[1] a considerable amount of work has been carried out to improve the methods and accuracy of colour measurement. Although interpretation of such measurements in terms of precise subjective effects is difficult,[2] these measurements are of considerable value for specification purposes and in the day-to-day control of lamp manufacture.

Light of the same colour may be produced by sources of very different spectral energy distributions. The colour appearance of the light from a tungsten filament lamp, for example, can be matched by a suitable blend of light from two monochromatic sources although, of course, the colour-rendering properties of the two lighting arrangements will be vastly different.

Various methods of colorimetry are possible in order to obtain a definition of the colour appearance of light sources. In visual colorimetry, the proportion and intensity of the light from three primary coloured sources are varied until the mixture matches in colour the lamp under test. The colour is then expressed in terms of the relative intensity of the three primary sources.

The choice of the primaries can be made from any three conveniently coloured sources so selected that a mixture of any two will not match the third. For use in visual colorimetry, various convenient primaries may be used and, for simplicity and uniformity in the presentation of results, an internationally agreed system was adopted in 1931 by the International Commission on Illumination. The results obtained in visual tricolorimeters, whatever their primaries, can be transformed to this international system. In modern practice visual colorimeters are rapidly being superseded by photoelectric colorimeters and these instruments indicate the chromaticity co-ordinates of the light source directly in terms of the international system.

The locus of spectral colours in the I.C.I. system is shown in Fig. 1 together with the locus of the light from a temperature radiator (such as a filament lamp) at various temperatures. This diagram shows the points which represent the colour

[1] G. T. Winch and H. R. Ruff, "Measurement, Representation and Specification of Colour and Colour Rendering Properties," I.C.I., July, 1948; *Trans. I.E.S.* (London), No. 1, 1951. G. T. Winch, "The Measurement of Light and Colour," *J.I.E.E.*, Pt. II, **96**, 452 (1949).

[2] G. T. Winch, "Colour and Lighting." *G.E.C. Journal*, **16**, 199 (1949).

appearance of some white fluorescent lamps including the new " mellow " colour.

It has already been stated that the measurement of colour appearance does not necessarily give any indication of the colour rendering properties of the source. An estimation by measurement of the colour rendering properties can only be made from a knowledge of the exact distribution of luminous energy throughout the visible spectrum. The measurement of a complete spectral energy distribution may be a lengthy process, but some photoelectric colorimeters, in addition to indicating the colour appearance, can be used to measure, in an abridged form, the spectral luminance distribution. This distribution is obtained by dividing the spectrum into eight internationally agreed spectral bands. The spectral distributions measured in this way of the light from a " mellow " colour fluorescent lamp and a tungsten filament lamp are shown in Fig. 2.

Despite considerable advances in the technique of colour measurement, it has not so far been found practicable to predict precisely the colour and spectral distribution required of a light source for a particular purpose. The difficulty, particularly with warm colours, is due in part to the large subjective effects which are sometimes produced by small measured changes. As an example, a small variation in the amount of green radiation has a pronounced effect on the colour appearance of a source. It is mainly because of the existence of such factors as this that the choice of the new fluorescent lamp colour for particular applications had largely to be made by subjective tests.

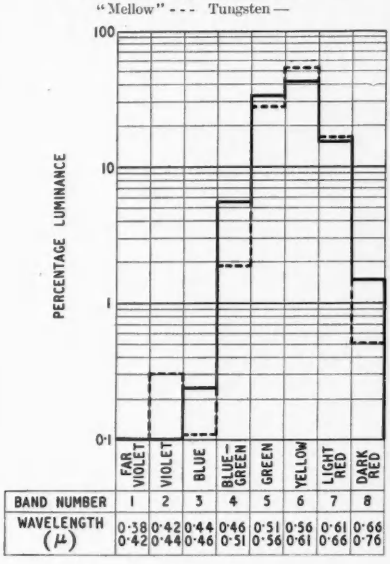
Selection of the New Colour

The choice of a suitable colour for domestic and social lighting therefore ultimately depends on the results of a number of subjective tests carried out first in the laboratory and later in trial installations. While the most important factor governing this choice is the colour rendering properties of the source, particularly for the human skin, foodstuffs, etc., the colour appearance of the lamp chosen and its luminous output throughout life must also be considered. Since luminous efficiency and the spectral energy distribution are inter-dependent, the efficiency level will be dictated by the spectral energy distribution chosen. It should nevertheless be noted that, owing to the low luminance of deep red light, it is not possible to increase the intensity greatly in this part of the spectrum (band 8, Fig. 2) without adversely affecting luminous efficiency. Fortunately, for a satisfactory social light, band 7 appears to be more important and an adequate intensity in this band can be provided without reducing the luminous efficiency below an economically desirable level. Since the colour appearance of the light source for social purposes should be cheerful and should strongly suggest the idea of warmth, some departure from the colour appearance of a full- or black-body radiator is permitted and indeed would appear to be desirable with this type of source.

The following range of tests will indicate some of the effects which were studied in selecting the new " mellow " colour, namely, the appearance of (i) the human skin, (ii) foodstuffs and beverages, (iii) fabrics and furnishings, (iv) white surfaces, such as tablecloths, etc. (which is in a sense a measure of the colour appearance of the lamp itself).

Laboratory scale tests of the above factors went some way towards the selection of a " short list " of possible variants, but

Figure 2.—Luminosity distribution for a " mellow " fluorescent lamp and a tungsten lamp operating at 2,850 deg K



it has been found essential to live with a new colour for a period before it is possible to make a final appraisement. Such longer term tests enable a worthwhile assessment to be built up under a variety of differing conditions. For this purpose field tests of one or two selected lamps were then initiated in installations in hotels and restaurants to obtain the reactions of the customers.

In trials of a slightly different nature demonstrations of the various possible colours were arranged in conjunction with representatives of the British Colour Council. The results of all these tests amply confirmed that the "mellow" colour fulfilled most satisfactorily the social lighting purposes for which it was designed.

Selection of Phosphors

It has already been stated that the production of a successful warm colour for domestic and social lighting is based on the use of phosphors emitting strongly in the orange and red regions of the spectrum. About 90 per cent of the light is emitted by the fluorescent coating and the remainder by the gas discharge itself. Although the proportion of the total light contributed by the mercury discharge is low, the subjective effect of the mercury spectrum is by no means unimportant. Since, however, the contribution of the mercury lines remains substantially constant, the fluorescent coating represents the main factor governing the colour characteristics of the lamp.

One of the major objectives in the development of fluorescent lighting over the past twenty years has been the extension of the range of phosphors so as to cover the complete visible spectrum. Starting from two or three naturally occurring minerals, such as willemite (fluorescing green) and scheelite (fluorescing blue), the number of phosphors excited by short ultra-violet radiation has been extended until to-day at least ten distinct families of useful phosphors are known. The palette of colours available thus enables the lamp designer to produce a wide range of saturated or white colours.

Although certain phosphors (e.g., magnesium and calcium tungstates) are fluorescent when in the chemically pure state, most synthetic phosphors are of the matrix-activator type. This means that they are comprised essentially of an inorganic crystal lattice known as the matrix, in which are dispersed relatively small amounts of one or more alien elements called the activators. The matrix is usually a compound of an element from Group II of the Periodic Table, while the activator is of a metallic nature from another group. For example, manganese is the commonest activator, either alone or in association with a second activator.

The spectral composition of the fluorescence of a phosphor is governed by the nature of the matrix and by the activator and is at present unpredictable from a theoretical standpoint. It has been found, however, that manganese as an activator nearly always leads to colours in the range from green to red, while there is also a degree of consistency in the colours produced by other activators. In Table 1 are set out the colour characteristics of a number of the main phosphors applicable to fluorescent lamps for lighting purposes. The phosphors are grouped in families which are related from the crystallographic or chemical aspects.

TABLE 1.—Colour Characteristics of Short U.V. Excited Phosphors

Matrix	Activator(s)	Colour of Fluorescence under 2537A.U. Excitation
Calcium tungstate	—	Blue
Calcium tungstate	Pb	Pale blue
Magnesium tungstate	—	Blueish white
Barium silicates	Pb	Blue or blueish white
Zinc orthosilicate	Mn	Green
Zinc beryllium silicates	Mn	Greenish yellow to orange
Calcium halophosphates	Sb and Mn	Blue to yellow or orange, including various whitish colours
Calcium silicate	Pb and Mn	Yellow or orange
Cadmium chlorophosphate	Mn	Orange
Cadmium borate	Mn	Red
Calcium phosphate	Ce and Mn	Deep red

It will be noted that certain groups (e.g., zinc beryllium silicates and calcium halophosphates) give rise to a series of colours. These colour changes are usually produced either by a progressive variation in the composition of the crystal matrix, or by changes in the concentration of the activator. Table 1 also shows that only the calcium halophosphates provide a series of white fluorescing materials in a single compound. Before these compounds were developed, the various "white" colours required were produced by mixing two or more phosphors. These additive colour

mixtures usually consisted of a blue fluorescing phosphor, such as magnesium tungstate, together with an orange or pink colour, such as that given by zinc beryllium silicate with or without the further addition of cadmium borate. The introduction of the halophosphates[3] has simplified the technical problems associated with the manufacture of phosphors, while an important advantage to the user has been the material gain in light output throughout the life of the lamp.

Colour Range of Halophosphate Phosphors

The halophosphates provide a series of colours extending throughout the greater part of the visible spectrum. While most other phosphors contain small amounts of activators, of which manganese is by far the most common, halophosphates containing manganese are not excited by short ultraviolet radiation, although a blue luminescence is induced by a small amount of antimony. In the presence of antimony, however, manganese has a profound effect on the fluorescence and causes the colour to change from pale blue through various whites to orange or pink, depending on the amount added. The final colour obtained can be controlled by either varying the amount of manganese present or by changing the composition of the matrix itself, for example, by the substitution of chlorine for fluorine. The colour changes brought about by these variables have made it possible to select suitable white colours to replace the older mixtures containing magnesium tungstate and zinc beryllium silicate. The resulting improvement in efficiency is partly due to the improved stability of the phosphors under high loading conditions.

Owing to their many advantages, therefore, the halophosphate powders were an obvious choice for the basic component in the phosphor to be used for the new "warm" colour for domestic and social lighting. Unfortunately, halophosphates do not emit strongly in the red region of the spectrum, so that it is usual, when "warm" light sources are required, to supplement the red by the addition of a phosphor such as cadmium borate. The spectral emission curves of a warm white halophosphate together with cadmium borate are shown in Fig. 3.

The colour-rendering distortion in the blue region produced by warm light sources has already been mentioned, and it has been pointed out that some measure of colour distortion must be accepted from such sources. The addition of a small amount of green light has, however, been found to reduce this "purpling" effect while still retaining the essential warm appearance of the lamp. In the "mellow" lamp a small amount of green fluorescing zinc silicate is added to the fluorescent coating. The spectral energy curve of zinc ortho-silicate, which is used to supply this additional green light, is also shown in Fig. 3.

The combination of the three phosphors (calcium halophosphate, cadmium borate and zince silicate) used in the "mellow" lamp gives rise to the spectral energy distribution shown in Fig. 2. Some other characteristics of this lamp are given in Table 2.

TABLE 2.—Characteristics of the 80 W "Mellow" Lamp

Efficiency at 100 hours	36 L/W
Average efficiency throughout life	30 L/W
Colour appearance of the lamp defined on I.C.I. colour diagram	x = 0·462 y = 0·377 z = 0·161

In developing a new fluorescent lamp colour for social and domestic lighting a number of physical and subjective requirements had to be satisfied. The warm colour appearance necessary in such a source can only be achieved at some sacrifice of the rendering of colours in the blue region of the spectrum. The resultant colour distortion is probably not greater than

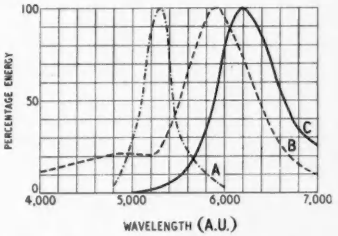


Figure 3.—Spectral energy curves for the component phosphors of the "mellow" lamp with (A) zinc orthosilicate, (B) a "warm white" calcium halophosphate and (C) cadmium borate

[3] A. H. McKeag and P. W. Ranby, B.P. 578,192; 578,195 (1942); 580,363 (1943).

that produced by a tungsten filament source. The " mellow " lamp, which was developed as a result of the investigations described above, has now been on the British market for over a year. It is nevertheless too early to make a final assessment of its suitability for general social lighting, since this particular field is one in which there are wide differences in personal tastes. On the whole, the new lamp appears to serve admirably the purpose for which it was designed and such criticism as has arisen has been due to the contrast effect produced when the warm " mellow " colour is used close to colder fluorescent lamp colours, or even tungsten filament lamps. In the absence of such contrasts, the potentialities of the " mellow " fluorescent lamp as an agreeable light source have been confirmed.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Participation in the Convention

I HEARTILY agree with the leading article in your issue of 15th June that the Convention should have the appropriate title and serve its main object of " bringing together the men and women of all sections of the industry for the purpose of getting to know one another and each other's problems." But does it actually do this fully? Does it rather not favour the few and neglect the many?

Being only some 30 miles from the Convention, I went over to Brighton for information, after having been told by the G.P.O. that there was a fault on the 'phone line (Why only one line at an important convention of this sort?) At The Dome I was informed that not being a delegate I could not enter. No other information was forthcoming. I had a lady friend with me who is interested in joining the E.A.W. Likewise, no information was available as to where and when contact could be made with the Association in Brighton.

Outside I was approached by a stranger, who in a very polite way explained that as I was carrying a copy of the *Electrical Review* I might be able to give him some information. It appeared that he was a local contractor who wished to get into touch with two or three of the big firms exhibiting. While we were talking another man who was parking his car within earshot of our conversation in an equally polite and helpful way asked, on overhearing our conversation, if he could be of assistance. He turned out to be the representative of one of the biggest electrical firms in the Midlands. The only conclusion we could come to was that this contractor, a man in the electrical industry, and myself, a man in the electricity supply industry, could only visit the exhibition on the day it was open to the general public—on the Friday, in fact in such a crush it would be almost impossible to talk and exchange information with the exhibitors—the latter being one of the aims of the Convention. Besides this, he could not find Friday convenient. Nor can I. My power station requires me at that time.

Now, I do not suggest altering the present organization of the Convention, but I certainly think it should cater for an *extra* section. Would it not, for example, be possible for *bona fide* electrical engineers (proof of which they could give), whether contractors or supply engineers, to obtain on payment a ticket admitting them to the exhibition and meetings? The great majority of us are not in the " upper ten," so have little hope of being sent as " delegates."

The greatest of all engineering and scientific conventions, i.e., the British Association meeting, recognized years ago that membership open to all qualified persons was of the greatest good in furthering the advance of science and industry. It seems opportune for the National Electrical Convention to adopt a similar policy. Moreover, the British Association is now encouraging papers by young engineers, as it recognizes that the new and useful idea does not always originate in the brain of the old timer.

The irony of the whole thing is that

although I am a member of the British Association which in Section G (Engineering) does not necessarily specialize in electrical engineering, I am debarred from attending my own specialist electrical convention because I am not a "delegate."

A simple admission ticket as "member" would bring not only new life and grist to the mill, but also a considerable additional income to the Convention's exchequer, as there must be very many others besides myself who wish to attend the Convention.

East Grinstead. A. STANLEY CUSHING.

Refrigeration Servicemen

AFTER reading in your 22nd June issue (page 1299) the report of a paper on refrigeration, read by Mr. E. G. Batt at the Brighton Convention may I be allowed to add a corollary?

Reading the concluding paragraphs of the paper, one may infer that the "training of service personnel" and "—the shortage of properly trained personnel—the two main reasons being perhaps, the hard technology of the subject, and the extraordinary growth of the industry, etc." are matters of great importance to be tackled immediately.

The Refrigeration Serviceman's Association has, since its inception some eighteen months ago, striven and is still striving to fulfil these long-needed requirements; it is our aim that the R.S.A. badge shall be the mark of a first class refrigeration serviceman. We have many members in this country, as well as abroad, and are a non-profit making concern. We have a branch at Bournemouth and others are pending. We enjoy the "blessing" of the British Institute of Refrigeration.

It is our earnest wish, and hope, that the Association of which Mr. Batt is director will give early recognition to a body which is eager to assist, and to share the results of its endeavours for the good of the whole refrigeration industry.

Wallasey, Ches. VINCENT J. DALY,
Hon. Gen. Secretary.
Refrigeration Serviceman's Association.

Electrical Executives

THE annual general meeting of the Association of Managerial Electrical Executive was held on 28th June. The newly-elected president, Mr. A. E. Morgan (London Electricity Board), referred to the protracted negotiations, commenced early in 1948, for the setting up of the "Fourth Leg" machinery. The British Electricity Authority claims that under the 1947 Act it is responsible for setting up the negotiating bodies and determining representation, but whilst it recognized the claims of the A.M.E.E. from the very commencement, it left the settlement of the difficult question of "lines of demarcation" to the associations concerned and this proved a difficult problem. A settlement has now been reached and as a result it is anticipated that the "Fourth Leg" agreement will be signed very soon.

This agreement sets up a National Joint Managerial and Higher Executive Grades Committee which in turn will appoint six sub-committees. The A.M.E.E. will have sole representation on the No. 1 Managerial Sub-Committee which deals with grades rising to over £1,500 per annum, and will also have a representation on the other sub-committees with the exception of that dealing with power station superintendents.

The other panels to be set up will provide for staff falling outside the N.J.B. and N.J.C. schedules not covered by Panel No. 1. District managers with salaries of £1,000 and above are included in Panel No. 6.

The A.M.E.E., as reconstituted, has opened its ranks to non-engineers possessing suitable professional qualifications, or with appropriate training and experience, holding executive appointments with managerial functions in the electricity supply industry.

The form of the negotiating machinery has now been laid down and it is essential that all grades shall be adequately represented on the national negotiating bodies. The Association is anxious to afford full facilities to the grades which it will represent and particularly invites the support of the non-engineering professions. The Association states that it is not its policy to engage in an active recruiting campaign with a view to building up a large Association, as it is desired to retain the more individualist and specialist nature which has always characterized the A.M.E.E.

Whilst the negotiation of salaries and conditions will be a main preoccupation in the near future, the Association is in a position to afford protection to its members. A recent arbitration award and the Association's claim for expectation under the 1941 agreement for former borough electrical engineers is a case in point.

VIEWS on the NEWS

By REFLECTOR

MR. V. W. Dale, the general manager and secretary of the British Electrical Development Association, says that in order to clear up one or two misconceptions he has had a survey made of the electrical and gas exhibits at the South Bank exhibition and a list has been prepared. As he says, the classification and arrangement of certain exhibits is unusual. As a result it is very difficult to be sure that any inventory is complete. Nevertheless it is certain that electricity permeates every section of the exhibition as an essential driving force whereas gas equipment, broadly speaking, is incidental and could generally be replaced by electrical methods. I do not deny that in a few cases gas has the advantage from the point of view of cost.

* * *

The advice offered on construction and equipment in "The Housing Manual, 1949: Technical Appendices," is not exhaustive, but attention is constantly directed throughout to other sources from which architects and builders may obtain additional specialized information, including guidance about house wiring. There is not much of the latter, but it is sound, consequently I think it is rather a pity that no more than four pages are included about standards of artificial illumination in the home.

* * *

At the Electric Vehicle Association luncheon last week Mr. George Strauss, Minister of Supply, said that one thing electric vehicle manufacturers would like him to announce was the remission of purchase tax upon their products. It is strange that although Mr. Strauss went on to give reasons (or excuses) why this could not be done, some people at the luncheon seem to have got the idea that he actually did announce the removal of the tax. This suggests (*a*) that speakers should be very careful in the use of humour (which this was intended to be) and (*b*) that listeners should not jump to conclusions from a preliminary statement but take due notice of subsequent qualifications.

* * *

I like to follow Sir Henry Self in his scriptural and literary excursions. At the E.A.W. Convention luncheon he spoke of the B.E.A. pursuing "Operation Ezekiel"—animating the dry bones of our economy with the wind of adequate electric power. The present power shortage, caused by a past lack of foresight, reminds me of the proverb quoted in *Ezekiel*: "The fathers have eaten sour grapes and the children's teeth are set on edge." I trust that the operation will succeed so that, as is said later in the same passage, we "shall not have occasion any more to use this proverb."

* * *

Because the maximum demand occurred at 6.30 p.m. on a day in December before the ban on shop window lighting came into force the South Eastern Electricity Board has refused to allow shopkeepers charged under a two-part tariff a rebate on the fixed charge. It is contended that the m.d. on that particular day was directly attributable to shop lighting. There is some substance in this for in the two preceding winters, if I remember rightly, the Board's m.d. occurred on a Sunday at midday. Nevertheless, shop-window lighting is for the most part an off-peak load and I rather feel that it would have been good policy to make some small concession to shopkeepers who have been unable to use their installations because of the ban.

* * *

Here is a piece of cold comfort from *Areatopics* (North Western Board):—

> "Those who complain bitterly about an occasional short cut would be interested to know that at St. Kilda in South Australia a consumer who, lacking both gas and coal, used his electric cooker during prohibited hours, was not only fined but was ordered to have his electricity cut off for 48 hours!"

PERSONAL and SOCIAL

News of Men and Women of the Industry

TO succeed **Lord Hyndley,** who is retiring from the chairmanship of the National Coal Board on 31st July, the Minister of Fuel and Power has appointed **Sir Hubert Houldsworth,** K.C., who has been chairman of the East Midlands Division of the Board since 1946. At the same time the Board is reconstituted, the other appointments being: deputy chairmen, Mr. W. J. Drummond and Sir Eric Coates; full time members, Mr. E. Edwards, Sir Charles Ellis, Sir Geoffrey Vickers and Sir Andrew Bryan; part time members, Mr. J. H. Hambro, Sir Geoffrey Heyworth, Mr. Gavin Martin, Sir Godfrey Mitchell and Alderman S. Jones.

Mr. V. Bowen, of the North Western Division of the B.E.A., has been appointed secretary of the No. 7 Sub-Area, North Western Electricity Board. Mr. Bowen was with the Salford Electricity Department for many years before nationalization.

The Minister of Fuel and Power has appointed **Mr. P. McNab Miln,** B.Sc., A.M.I.Mech.E., A.M.I.E.E. (Manchester), to be deputy chairman of the North Western Electricity Consultative Council in place of Alderman W. W. Cocker, O.B.E., J.P., M.A., who has resigned for business reasons.

Drysdale & Co., Ltd., Yoker, Glasgow, announce that **Messrs. F. J. B. Henderson,** B.A., **C. H. Carslaw,** B.Sc., A.M.I.Mech.E., and **T. L. Mackie,** A.I.Mar.E., have been appointed additional directors of the company.

Mr. C. St. L. Brightman has been appointed manager of the Newcastle branch of W. T. Henley's Telegraph Works Co., Ltd., in succession to Mr. M. B. Wilson, who retired on 30th June. Mr. Wilson's services are being retained in a part-time capacity in connection with the branch business.

Mr. C. St. L. Brightman

Brigadier J. Field has been appointed general superintendent of the State Electricity Commission of Victoria's power and fuel centre at Yallourn.

Mr. W. F. Parker, M.I.E.E., has been elected national chairman of the Association of Supervising Electrical Engineers for 1951-52. Mr. Parker received his technical training at the Birkenhead and City of Liverpool Technical Colleges, after being awarded a Hulme Lever scholarship. He served an electrical engineering apprenticeship with Lever Bros., Ltd., Port Sunlight, where he gained a wide experience in electrical maintenance and installation work of all kinds, including a period in the company's central power station. In 1935 he joined the staff of J. Stinton Jones & Partners, consulting engineers, and he became deputy chief engineer of the Bective Electrical Co., Ltd., in 1938, being appointed their Midlands branch manager later, and chief engineer in 1942. He joined Troughton & Young, Ltd., in 1945, and became technical director in 1946.

Mr. W. F. Parker

Mr. Parker joined the Association in 1938. Since 1943 he has served on many of its committees and he has been an adviser in the A.S.E.E. Diploma Scheme since 1945. He was elected to the Executive Council in 1947 and in that year became vice-chairman of the Southern Regional Council, being elected chairman in 1948. He was secretary of the North West London branch in 1947-48 and was elected branch chairman the following year.

Mr. L. L. Emmett (Leeds), has been elected vice-chairman of the Association and **Mr. E. J. Sutton** has been re-elected honorary treasurer.

Mr. A. L. Stock has been appointed a director of the Morgan Crucible Co., Ltd., in place of the late Mr. H. C. Mills.

Davey, Paxman & Co., Ltd., have appointed **Mr. W. A. Sycamore,** M.I.N.A., M.I.Mar.E., as defence programme manager, and he will undertake the co-ordination of the firm's activities and all liaison with the Admiralty and other Government Departments in connection with the national rearmament programme. **Mr. H. V. Stead,** M.Sc., is appointed commercial manager

(engines), **Mr. H. P. Brown** becomes assistant commercial manager (engines), and **Mr. J. A. Bennett-Powell** is appointed traction sales manager.

Over 40 guests were present at a luncheon at the Savoy Hotel, London, on 19th June

At the luncheon given by Mr. V. C. H. Creer: *Left to right:* **Mr. A. W. Jervis, Sir Charles Mole, Mr. Willard Brown and Mr. Creer**

given by Mr. V. C. H. Creer, director of lamps and lighting, British Thomson-Houston Co., Ltd., in honour of **Mr. Willard Brown** and **Mr. C. M. Cutler,** of the American General Electric Co. Mr. Willard Brown is a past-president of the American Illuminating Engineering Society and a member of many important committees in the United States concerned with lighting practice. Mr. Cutler is also prominent in the American I.E.S. and is an acknowledged authority on festival lighting. They were both to contribute papers before the International Illumination Congress in Sweden.

Mr. Nicol Gross, Ph.D.(Cantab.), A.M.I.Mech.E., has been appointed assistant director of research, British Welding Research Association. Dr. Gross will continue his responsibility for the Association's engineering researches and will remain in charge of the Research Station at Abington. **Mr. K. Winterton,** Ph.D., B.Sc., and **Mr. H. E. Dixon,** M.Sc., have been appointed chief metallurgists, the former for ferrous metals, and the latter for non-ferrous metals. **Mr. C. L. M. Cottrell,** M.Sc., and **Mr. P. T. Houldcroft,** B.Sc., become assistant chief metallurgists for ferrous and non-ferrous metals respectively.

Mr. P. D. F. Varrall has been appointed secretary of Johnson, Matthey & Co., Ltd. **Mr. L. C. Montague,** secretary from 1934 to date, will now give the whole of his time to his work as a joint managing director, a position which he has held in conjunction with the secretaryship since 1946.

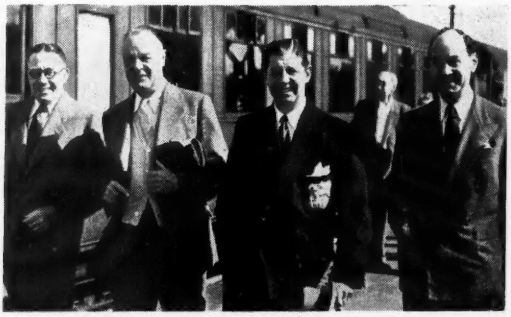
Mr. S. G. Hibben, director of applied lighting, Westinghouse Electric Corporation has been elected president of the American Illuminating Engineering Society for 1951-52. The new vice-president is **Mr. A. H. Manwaring,** of the Philadelphia Electrical & Mfg. Co., and the general secretary is **Mr. C. C. Keller,** Holophane Co., Inc., New York.

Bailey Meters & Controls, Ltd., have arranged a novel day's outing for executives and members of their staff. The company has chartered four planes to fly from Croydon to Sandown in the Isle of Wight. After lunch at Ryde the party will make a coach tour of the island, and will return at 8 p.m. in the evening.

The staff of the **British Central Electrical Co., Ltd.,** went to Brighton for their annual outing on 16th June. The side-shows on the Pier were well patronized and a number of the party went swimming at the Black Rock Pool.

The seventh annual sports meeting of the **Telcon Social & Athletic Club** (Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd.) was held at the Kidbrooke Sports Ground on Saturday last. Lord Colgrain, chairman of Telcon, who recently celebrated his eighty-fifth birthday, presented the prizes and trophies, and Dr. G. A. V. Sowter, chairman of the Club's General Purposes Committee, introduced the successful competitors. In the evening there was dancing in the Club's pavilion to the Mulvaney (Telcon) Dance Band.

The annual outing of **Benjamin Electric, Ltd.,** took place on Sunday, 17th June when a special Pullman train took the party to



Benjamin directors on the company's annual outing: *Left to right:* **Messrs. L. R. Kavanagh, A. E. Iliffe, H. G. Campbell and H. L. Smith**

Yarmouth. A photograph of the directors taken on the occasion is reproduced.

The Liverpool Electric Cable Co., Ltd., recently held its annual billiards competition for the "A. N. Smith" cup, which was eventually won by Mr. J. W. Gardner (Sales Dept.) who beat Mr. J. T. Frost (works manager). Winner of the bowls competition for the "W. J. Terry" cup held on 16th June, was Mr. T. Coley who beat Mr. W. Murrell.

The Hon. Mrs. Leslie Gamage presenting prizes at the G.E.C.'s recent 26th annual sports and gala at Wembley, reported in last week's issue

OBITUARY

Mr. G. Geoffrey Smith.—By the death of Mr. G. Geoffrey Smith, M.B.E., on 29th June, at his home at Radlett, Herts, after a short but severe illness, technical journalism loses one of its best-known figures. Mr. Geoffrey Smith was born 66 years ago at Newark, Notts, and after an engineering apprenticeship with Ransome & Marles, Ltd., joined the editorial staff of the *Motor Cycle*, under the proprietorship of Lord Iliffe, in 1904; eight years later he became that journal's editor. He was made an M.B.E. for his services during the 1914-18 war. In the inter-war years he assumed direction of an increasing number of Iliffe journals. He was a director of Iliffe & Sons, Ltd., Associated Iliffe Press and a number of subsidiary companies. During the second world war he served on numerous technical and Press committees, and advisory panels, and in 1944, at the invitation of the Government, he spent nine months in America publicizing Britain's technical achievements and the benefits that would accrue from mutual aid in the production field.

Mr. Geoffrey Smith was among the earliest, apart from the few technicians directly involved, to recognize the potentialities of jet propulsion; and his writings, lectures and broadcasts, though necessarily circumscribed in context by the need for secrecy, did much to further the cause of a new and vitally important science. He was the author of *Gas Turbines and Jet Propulsion*, a standard work now in its fifth edition, and he was also responsible for *Modern Diesel* (14 editions).

Mr. A. P. Hayes, A.M.I.E.E., Derby and Burton Sub-Area engineer, East Midlands Electricity Board, died on 28th June in his 60th year. He joined the Derby Corporation Electricity Department in 1908 and was mains superintendent from 1917 until 1948 when the industry was nationalized. Mr. Hayes was chairman of the Derby Branch of the Electrical Power Engineers' Association.

Mr. J. Collinge.—The death is announced of Mr. John Collinge, who was power station superintendent with the Salford Corporation Electricity Department before his retirement in 1931. He was eighty-four years of age.

Mr. Wallace Lionel Pitcher, for many years in business as an electrical contractor in Folkestone, died on 4th June aged fifty-five. He had been in the electrical trade for over forty years, having been apprenticed to the late Mr. Robert Webster, Folkestone's first electrical contractor, in 1909. He was a member of the E.C.A.

Mr. William Hadfield, who has been in business as an electrical engineer and retailer in Swinton, Lancs, for the past twenty years, died on 12th June at the age of sixty-three.

Mr. C. F. Collins, chairman of Collins Electrical, Ltd., died at his home at Southall, Middlesex, on Monday. The funeral was to take place yesterday (Thursday).

WILLS

Mr. J. E. Grant, formerly manager of the electrical carbon factory of the Morgan Crucible Co., Ltd., who died on 26th January last, left £50,305 gross (£42,071 net).

Viscount Elibank, formerly deputy chairman and joint managing director of the Southern Area Electric Corporation, Ltd., who died on 11th March, left personal estate in England and Scotland valued at £11,529.

Mr. D. B. Mellis, former chief electrical engineer with Erskine, Heap, who died on 8th February, left £26,429 gross (£26,368 net).

Mr. W. E. Gough, A.M.I.E.E., of the aeromagneto engineering and design staff, Coventry, of the British Thomson-Houston Co., Ltd., who died on 10th January, left £16,330 gross (£16,285 net).

The Royal Show

Growing Electrical Applications on the Farm

THE increasing dependence of the farmer on electrical aids is more than ever in evidence at this year's Royal Show which concludes to-day at Trumpington, near Cambridge. The main centre of electrical interest, "Electricity Farm," which has become a regular and popular feature of the Royal Shows for many years, occupies a larger site than hitherto (18,000 sq ft) and has further extended its scope.

Occupying a prominent position close to the Grand Ring and landmarked by a concrete "H" pole, the exhibit is designed to represent a farm situated in the main road running through a village and the two-story concrete farm house is arranged as a typical rural electricity service centre. On the ground floor there is a display of domestic electrical appliances and an inquiry bureau, while the upper floor is used as the organizers' offices. Alongside the service centre there is a street lamp and a public telephone kiosk, and near the entrance to the farm there is a duck pond.

Modern Farming Methods

The exhibit, which has been organized by the British Electrical Development Association in co-operation with the Eastern Electricity Board, provides much of interest in the application of electricity to farming activities ranging from a cattle de-horner to a full-scale "in-sack" grain drying installation. Covered-in accommodation is provided for the main part of the exhibit by the use of all-concrete farm buildings which house electro-agricultural equipment for modern farming activities. These activities embrace dairy farming, water pumping, workshop technique, barn machinery, poultry husbandry, crop treatment and horticulture. The dairy section includes a producer-retailer dairy layout complete with milking plant, together with sterilizing, milk cooling and ancillary equipment, the majority being capable of demonstration.

Pumping units for various purposes are demonstrated and the section devoted to workshop practice includes arc-welding demonstrations, timber sawing and a comprehensive display of wood and metal working tools. A small up-to-date automatic hammer mill installation, together with other equipment for the preparation of farm foodstuffs, is incorporated in the barn machinery section.

"In-Sack" Drying

An interesting feature in the crop treatment section is the 20-sack grain drying plant of the "in-sack" platform type, together with ancillary requirements for this method. Horticulture is covered by working demonstrations of low voltage soil warming for greenhouse work, propagating and various types of frame-growing and cold glass culture, whilst soil sterilizing is also catered for.

Among exhibits of individual manufacturers the General Electric Co., Ltd., displays a wide range of electrical equipment for both agriculture and horticulture. Duct air heaters with "Propeller" and "Aerofoil" axial flow fans manufactured by Woods of Colchester, Ltd., an associate company, are in considerable demand for in-sack platform dryers, ventilated bins and barn hay drying. As an example of a low-priced installation, a 10-sack grain drying unit is shown consisting of a 12in diaphragm-mounted propeller fan with a 14in square duct air heater with a loading of 14 kW. Complete with control gear the price is under £70. For grain drying in ventilated bins the "Aerofoil" dual-duty fan with a rating of 8–9 h.p. is coupled to a 21 kW duct air heater.

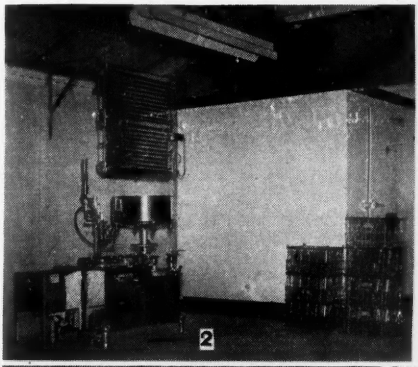
Dairy sterilizing equipment gives prominence to low-loaded appliances including the storage block sterilizing chest with a loading of 1 kW and a storage steam raiser. The 2 kW combined storage block steam raiser and water heater is also shown, together with a new 50-gall water heater (4 kW or 5 kW) and directly heated chests with feeds specially designed for hard water. Pig farrowing heaters and a 2½ cwt double-rope hoist are other interesting items.

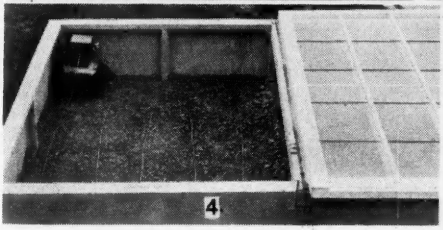
In the horticultural section, besides a display of soil warming for garden frames, here is an example of a new light source for plant irradiation. Soil sterilizers include both commercial units and a small model for amateur use. Lighting fittings, lamps and domestic appliances complete the display.

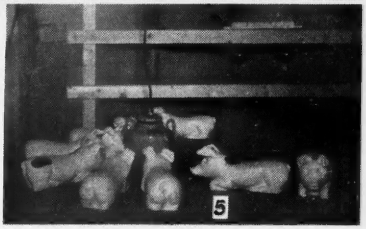
Among milking machines Vaccar, Ltd., have a new four unit portable recorder and milking service equipment designed for large cowsheds or for use in the open. Although the actual exhibit is engine driven, the outfit is also made for electrical operation with a hot water supply provided from a thermostatically controlled electric immersion heater. At the back of the three-wheeled chassis is a platform which lets down to form a table upon which the udder washing equipment is available for preparing the cows prior to milking. The outfit operates on the controlled pulsation principle so that there is no variation between one unit and another and recording scales are provided. Accompanying this outfit are two single unit portable milkers as well as static installations of both bucket and releaser types.

Portable and fixed electric milking plants are also to be seen on the Fullwood & Bland stand. The portable units include both a two bucket type and a recorder unit, while among the fixed plants are tandem recorder releasers and direct releasers for the small herd. Besides combined recorder, pulsator and portable milkers, the Alfa-Laval Co., Ltd., includes in its display milk coolers and cream separators.

In the new Gascoigne "Rotor-freeze"







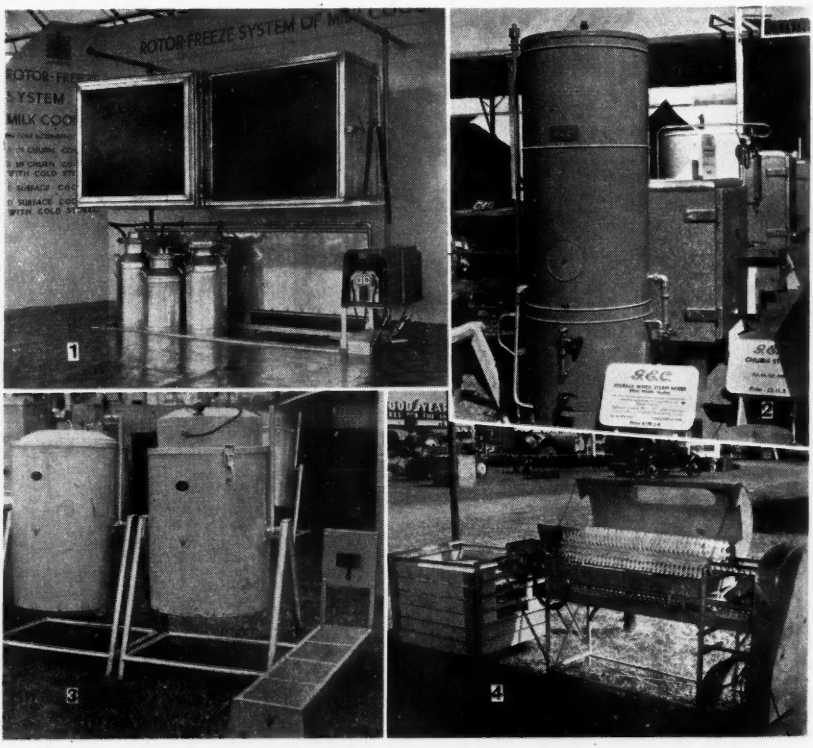
Electricity Farm: (1) The farm house. (2) Milk cooling section. (3) "In-sack" grain drying. (4) Soil heating in a cold frame. (5) Floor and overhead radiant heating for pig farrowing, also electric foster mother

cabinet type milk cooling equipment six standard churns of milk can be cooled at a time. Chilled water from a large ice bank in the base is spread over the outside of the churn by means of a rotary cover, on which a specially designed agitator ensures a constant movement in the milk with a correspondingly higher rate of cooling.

Various models of the "Electrobloc" self-contained heat storage sterilizers with overheat protection are shown by J. W. Woolley & Co., Ltd. The chests reach a temperature of 210 deg F in 10 minutes and models are available to give up to 80 gall of hot water. Separate heat storage steam generators are also available with loadings up to 9 kW to cover the whole of the steaming requirements of the dairy.

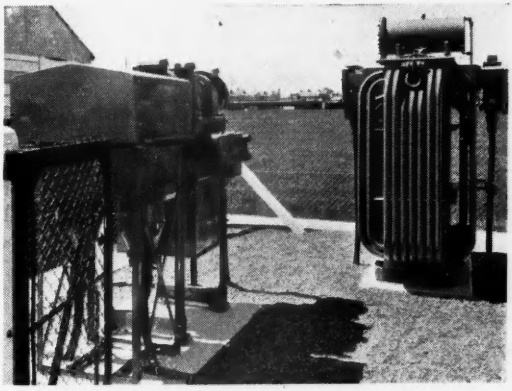
Perkins' Clean Milk Equipment's new sterilizing, hot water and steam boiler, the "Atom Block," which is oil heated but electrically controlled, gives both saturated or superheated steam reaching a temperature of over 400 deg F. It will provide a continual supply of hot water within five minutes from starting up, and within eight minutes will produce steam at high temperature for sterilization. Other Perkins exhibits are bottle fillers and aluminium cap makers, chilled water farm cooling units and the "Patomatic Midget" fully electrically controlled automatic steam boiler, a smaller version of the unit exhibited in previous years.

Refrigeration plant is particularly well represented on the International Refrigerator Co.'s stand. Farmers display



(1) Gascoigne "Rotor-freeze" milk cooling plant. (2) G.E.C. storage block steam raiser with water heater and other products. (3) Woolley potato steamer. (4) Curfew egg washing apparatus

particular interest in the "Coldrator" 200 cu ft and 300 cu ft dairy cold rooms, the milk cooling equipment and the range of condensing units. The new SC 13 (13 cu ft) and SC 18 (18 cu ft) service cabinets are both now being equipped with hermetically sealed units. Other new "Coldrator" equipment is an ice-cream conservator fitted with back display for frozen food, forced draught cooling coil, and the frozen food conservator designed primarily for the farm household.



Distribution substation comprising h.v. ring-main control unit, coupled to an oil-immersed circuit-breaker and 500 kVA transformer

In addition to displaying its latest dairy chill room, ice-bank milk coolers, service cabinets, display counters, frozen food storage and display cabinets, Frigidaire Ltd., carried out an interesting refrigerated air cooling installation for the National Sheep Breeders' Association carcass exhibition. This exhibit also includes four large display and storage cabinets for cut meats.

The Pressed Steel Co.'s exhibit consists of three "Showmobiles" (mobile exhibition vans) displaying the company's full range of commercial refrigeration equipment, milk coolers, display cabinets, cold rooms, etc. J. & E. Hall, Ltd., have, in actual operation, display cabinets, coolers, and a fish slab.

A radio device for locating ferrets underground is one of the latest products of the Wolseley Sheep Shearing Machine Co., Ltd., whose other products include electric fencers, power-operated sheep shearing and cattle clipping machines, a dairy bucket heater and the "Wolseley Coldrator" chilled water milk cooling unit.

One of the most comprehensive displays of poultry equipment has been arranged by Curfew Appliances, Ltd., on whose stand may be seen incubators of all sizes from 60 to 18,432 egg capacity, combined incubator brooders (30–100 eggs), chick cabinets, holding 1,200 day-old chicks, egg testing tables, brooders, hovers, conversion units for incubators and brooders, a washing machine for wire floors and dropping trays, an egg washing machine (2,000 an hour), and 25 and 45 gall potato and swill steamers.

Stephens' incubators are represented by 12,000 and 150 egg units, while Western Incubators, Ltd., have on view 9,000 and 928 egg types as well as a brooder. Electrically operated automatic feeding and cleaning laying cages and electrically cleaned fattening cages are demonstrated by the Visi-Chick Brooder Co., Ltd.

The new "Fibrejector" hammer mill made by Christy & Norris, Ltd., makers of

Woolley "Electrobloc" with overheat protection

the well-known " Essex " mill, is a notable item of barn equipment. Bamfords, Ltd., show their hammer mill, " Rapid " mills for grinding and crushing, root cutters and combined root cleaners and cutters.

For measuring the moisture in cereals, ground wheat and flour, timber, etc., the Marconi Instruments moisture meter is portable, battery operated and simple to use. The same company's portable pH meter can be used for determining the acidity or alkalinity of soil as well as of milk or aqueous solutions in general.

A demonstration of colour television by Pye, Ltd., is attracting a great deal of attention. One section of the company's stand acts as a studio where the live show is televised while another forms a theatre, which, fitted with six television receivers, holds approximately 200 people. The centre section of the stand is made up of displays of television, radio and telecommunication equipment; instrument landing systems; scientific productions of W. G. Pye, Ltd.; and a display of household cooking equipment by L. G. Hawkins & Co., Ltd.

Further domestic appliances are to be seen on the stand of the Eastern Electrical Co., Ltd., whose exhibit includes Marco and Astral refrigerators; " Servis," Hoover, Thor, English Electric and " Versco " washing machines; wash boilers; Hoover, Vactric and Electrolux cleaners; a Vactric polisher; " Philishave " dry shavers and " Sadia " and Berry's water heaters; as well as small appliances. Wilkins & Mitchell, Ltd., have a stand of their own on which they show their " R " model washing machine.

For the use of farmers who have no public electricity available A. C. Morrison (Engineers), Ltd., have a wide selection of self-contained fully automatic diesel-electric generating plants from 1½ kW upwards for 230 V a.c. and also petrol engined battery charging sets from 250 W upwards.

For the distribution substation provided for the Show, a Crompton Parkinson type " AO " high voltage ring-main control unit has been used coupled to a type " B3D " oil-immersed automatic fuse operated " T.A.P." circuit-breaker with a B.E.T. 500 kVA transformer. This equipment has been specially designed for safe and reliable operation for rural distribution. It is simple and therefore easy to maintain and economical in first cost.

Electric Motors in Agriculture

IN the accompanying table showing the approximate number of electric motors used in agriculture the figures up to 1948 are based on tables published by the Agricultural Economics Research Institute, University of Oxford. Those for 1950 are taken from the agricultural machinery census tables for England and Wales and for Scotland. The Oxford tables give a scientific calculation of the horse power of electric motors in agriculture for the whole of Great Britain. From 1,000 h.p. in 1908 the total rose to 23,000 h.p. in 1939; 62,000 h.p. in 1942; 148,000 h.p. in 1944; 192,000 h.p. in 1946; and 232,000 h.p. in 1948.

Number of Electric Motors in Agriculture
(to nearest thousand)

	1931	1939	1942	1944	1946	1948	1950
England and Wales ..	3·1	11·0	25·0	35·0	47·9	61·0	81·0
Scotland ..	0·4	2·0	3·8	4·5	6·3	8·0	10·75
Total ..	3·5	13·0	28·8	39·5	54·2	69·0	91·75

Batti Wallahs' Society

PUBLIC transport and its many ramifications were discussed by Lord Hurcomb, chairman of the British Transport Commission, at a luncheon of the Batti-Wallahs' Society at the Connaught Rooms, London, on 27th June. Lord Hurcomb said that considering that the annual turnover of the industry was over £550 million the deficiency was small. It was not possible to adjust fares against rising costs in the same way as other industries. Before the talk Sir John Hacking, who presided, presented past-presidents' badges to Col. H. J. Wellingham, Mr. Forbes Jackson and Mr. H. Nimmo.

Street Lighting Schemes

WARRINGTON Corporation has approved a recommendation of the borough surveyor to substitute electric lighting for the existing gas lighting in Knutsford Road, from Bridge Foot to Grove Street and Wash Lane to Forest Street; and from Parker Street to the borough boundary in Liverpool Road. Application is to be made to the Minister of Transport for consent to the borrowing of £6,216 to cover the cost.

Electric street lighting is to replace gas at STONEHOUSE, Glos, as soon as the Midland Electricity Board has obtained Ministerial sanction.

A further £8,000 electric street lighting scheme is under consideration by HINCKLEY U.D.C., covering the road between the Watling Street and extending to Hill Top at Earl Shilton.

The street lighting in High Street, ASHBY, Lincs, is to be replaced by mercury discharge lighting.

Peak Load Control

Time Switching Water Heater Load

By W. A. DEVON,
ASSOCIATE I.E.E.*

THIS article is an attempt to show how time switches and frequency-sensitive relays can be used to help in laying the peak load bogy. That the schemes suggested form only a part solution to the problem is appreciated, as is also the fact that considerable research will be involved in determining the effect of local peaks on the load characteristics of a national load, when the technical and commercial virtues are being assessed.

Nevertheless it is proved in theory and practice that considerable advantages attend the adoption of the form of control outlined. Although an actual load curve may have no resemblance to the example quoted, it is most unlikely that load created by any type of community cannot be moved in time, with a resulting improvement of system load factor.

No matter where on the daily load sheets the peak occurs the problem is always to remove the hills and valleys so as to raise the load factor from the usual figure of 35 per cent, meanwhile maintaining good service to all consumers. There are two distinct approaches: the negative action of switching consumers " off " as the load approaches the maximum output of the generating station, or a more economically sound interpretation of load levelling by moving certain sections of load from peak to valley without interruption of a reasonable service.

It may be once, twice, or three times a day that the emergency arises, but the times at which it occurs each day remain constant within fairly close limits depending upon the preponderance of certain appliances and the domestic habits of the community. The major domestic load is usually made up of space heating, cooking and water heating and it is by controlling the times that they may be used in relation to the industrial demand that a diversity is produced which leads to a reduction of the peak and an improvement of load factor.

To deprive consumers of all service at any time creates criticism and antagonism. But certain restrictions can be imposed that are almost unfelt by the consumer and, in the forefront, is the control of storage water heaters. The 3 kW immersion heater fitted to the tank of an existing hot water system has become popular, but domestic habits in any selected community show little diversity so that washing and meal times occur almost simultaneously.

It follows, therefore, that recovery of hot water heaters occurs simultaneously which, if coincidental with space heating or cooking loads, can provoke a critical situation.

Consider the advantages that would accrue if this water heater load could be moved in time along the daily load curve by automatically switching it " on " and " off " at advantageous times. By 9.30 a.m. the greater part of the civil population is engaged in business, early morning cooking is completed and electrical space heating is considerably reduced, especially in the case of married couples both being engaged in business (a higher proportion now than at any time). These circumstances tend to produce a valley in the load curve which can conveniently be filled by bringing " on " the water heater load.

By 11.30 a.m. the midday cooking load is building up and the danger of another peak is imminent. As the water heater has by now recovered, no hardship will be felt by a consumer if the heater is switched " off " until the cooking load is reduced, which normally occurs at about 2 p.m. when, the tank having been partially emptied for washing up, the heater should be restored to the mains until approximately 4 p.m.

Lighting and space heating in flats and houses of returning business people now cause another upward trend in the load

* London area manager, Venner Time Switches, Ltd.

curve which remains fairly steady until approximately 11 p.m. when it falls to a low level until about 8 the following morning.

The restoration of water heaters some time after 5 p.m., when the industrial load is usually reduced to such a level that there is no further danger of a peak, is a matter of local preference. There is a good case for permitting their use right through the evening to provide baths, etc., and leaving them under thermostatic control until 7.30 the following morning.

There is a time switch (Fig. 1) specially designed for the above programme. It is type "MWNZXV," is independent of frequency variation and has a 36-hour spring reserve to enable it to keep accurate time in the event of a power supply failure.

Adjustment to Summer Conditions

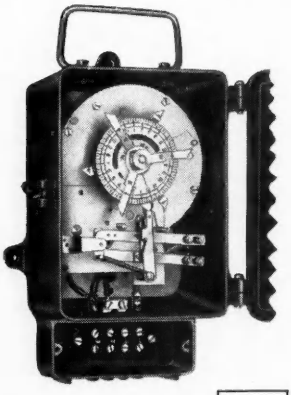
A refinement of design enables one, two or three pairs of clock hands to be operative and they can be easily and quickly re-set by a meter reader should it be considered desirable to provide longer periods of water heating during the summer months. A factor to be considered during the summer months is the possibility of restricting water heating loads to reduce the already low peak to the minimum, enabling plant to be removed for overhaul. Alternatively one short "off" period daily could be arranged at a convenient time, leaving long periods when the water heater load will compensate in some measure for the lost heating load and in this way help to raise the load factor, it being assumed that the industrial load remains fairly constant throughout the year.

Another method is to attract water heater load within certain hours by offering a special low tariff during those times, or imposing a high rate during peak hours. This scheme, which does not at any time withhold supply, relies upon the consumer switching "off" and for that reason does not so readily solve the problem. Furthermore, tenants leaving their flat in the morning cannot leave the water heater "on" without penalty and must therefore leave it "off" and return in the evening to lukewarm water, or employ a secondary time switch. Two meters or a two-rate meter are essential to this arrangement (Fig. 2) and the additional capital cost must also be considered.

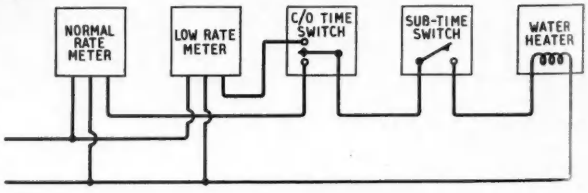
Frequency-Sensitive Relay

A third and the most effective method of load control is by frequency-sensitive relays. In the previous examples, danger periods are assessed from the average of the daily load curves and the switches are arranged to control selected loads at set times each day.

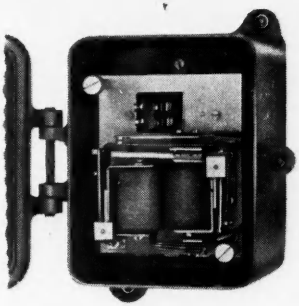
While this procedure is in the main accurate it can be argued that in winter months an unseasonable warm period could reduce the general heating load to an extent that would make control of water heaters unnecessary. Conversely an exceptionally severe period could increase the space heating load to an unprecedented level and, in spite of water heater control, widespread power cuts would result. By using a frequency-sensitive relay (Figs. 3 and 4) inflexibility of previous schemes is overcome without the surrender of any of

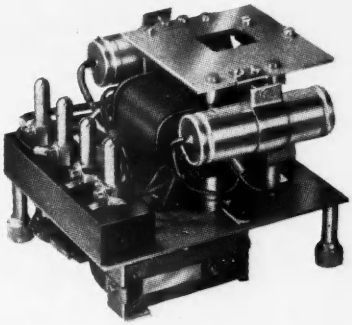


Above: **Fig. 1. — Specially designed type "MWNZXV" time switch for water heating and industrial peak control**



Right: **Fig. 2.—Two-meter or two-rate meter circuit arrangement for discriminative tariff**





Figs. 3 and 4.—Frequency-sensitive relay with two tuned reeds visible through aperture above the latched-in type relays which they control and (*right*) method of plugging into the switch base

the advantages. For example, consider a relay with two reeds tuned to vibrate with maximum amplitude at say 50·5 and 49 c/s. Normally a pair of contacts integral with the relay and in series with a selected load are closed and both reeds are quiescent. As the load on the system increases to an extent which causes the alternators to slow down, the reed tuned to 49 c/s begins to vibrate with increasing amplitude until the frequency of the supply system falls to that figure.

The amplitude of the reed vibrations is now such that a contact on its tip touches a fixed contact that operates a solenoid which trips the main contacts, automatically disconnecting the selected load. The contacts remain open until they are reclosed by the operation of the other reed, which can only occur when the frequency is raised to 50·5 c/s, namely when the alternators can again accept the load previously shed under duress.

Under extreme conditions the automatic shedding of the water heating load may be insufficient to relieve the system overload and the frequency will continue to fall. A second line of relays tuned to operate "off" at 48 c/s can be arranged to shed load considered to be the next least essential, but the most essential supplies will be maintained.

With the passing of the emergency the second-line load shed will be reinstated first by the 50 c/s "on" relays and at a later time, as soon as acceptable, the first-line will also be restored by the 50·5 c/s "on" relays. An important feature of these relays is that, though nominally the reeds are tuned to specific frequencies, they are in fact slightly separated by the usual manufacturing tolerances. The effect is to provide a very useful diversity and, by varying the frequency slowly, a load shed or reinstatement can be spread over several minutes, so preventing any hunting of alternators which might result from a sudden major increase or decrease of load.

Visual Warning Method

One other possibility might be considered for larger power consumers. Voluntary load shedding might be stimulated by fitting two frequency-sensitive relays with lamps, one glowing at 49 c/s to indicate that, say, 5 per cent load must be cut, while the second, operating at 48 c/s, would be a warning that a total cut will follow in a few minutes unless an immediate and substantial reduction (which could be predetermined) is effected. In this way each factory would suffer the same degree of inconvenience.

Where factories, public institutions and domestic premises are connected to the same feeder, the domestic load could be time switch controlled at peak hours. This, combined with the voluntary power load shed, would ensure continuity of supply to public institutions and no lighting circuits (factory or domestic) would be disturbed, thus promoting greater safety. The inconvenience of partial control would be suffered by domestic and power consumers proportionately, causing a fellow-feeling which should unite rather than antagonize sections of the community.

From the foregoing it will be apparent

that the technicalities of peak load control are not insuperable, but any such scheme must also be commercially sound if its adoption is to be recommended. Control gear of the type described increases revenue automatically because of the resulting improved load factor and the complementary effect of a full 24-hour running, as opposed to the prolonged daily cuts suffered in some areas.

Furthermore to carry a steady load of 1 kW an average capital layout of £70 is involved. The manner in which peak load control can enable additional load to be accepted without incurring this expenditure will be appreciated from the following example:—

Consider a district containing 1,000 consumers, each equipped with a 3 kW immersion heater, in an area where the mains and the generating station are loaded to capacity. Assuming an existing diversity of 50 per cent, time switch control would move 1,500 kW from the peak so (if the system had been maintaining the load satisfactorily before the installation of control gear) it follows that 1,500 kW of additional load should now be acceptable. Under the best conditions this additional load could be spread without involving much capital expenditure; even if the latter amounted to £20/kW there would still be a saving of 1,500 × £50 = £75,000.

Installation costs should not amount to more than £500 in which case the balance sheet per 1,000 consumers should show the following saving:—

	£	
Capital expenditure to provide 1,000 time switches	10,000	Saving of capital expenditure in accepting 1,500 kW load at £70/kW
Interest on the loan repayable over 20 years ..	6,048	
Capital expenditure on connecting 1,500 kW new load	30,000	
Cost of installing time switches	500	
Net saving	58,452	£105,000
	£105,000	£105,000

Should fresh load not be connected, as in the above example, the removal of 1,500 kW from the peak at £4 2s 6d/kW would still show a reduction of £6,178 10s yearly on maximum demand charges. The capital expenditure of £10,000 involved in obtaining this relief, written down over 20 years, including interest, would amount to £862 10s yearly, a net saving of £5,316.

Housing Manual Appendices

Standards of Good Practice

THE latest "Housing Manual, 1949: Technical Appendices" (H.M. Stationery Office, price 2s) brings up to date and expands the information contained in the 1944 manual. It seeks to establish a minimum standard of good practice in the construction of all types of dwellings and has been compiled by the Ministry of Works in collaboration with the Ministry of Health (whose housing functions now belong to the Ministry of Local Government and Planning), the D.S.I.R. Building Research Station and the Ministry of Fuel and Power.

Functional standards are set out and practical ways and means of attaining them, with economy of cost and in the use of materials, are described. For instance, Appendix F, on the heat installation, contains information intended to facilitate the selection and installation of room warming, cooking and water heating appliances of all sorts. An electric immersion heater in a hot water storage vessel, or independent sink heater, is mentioned as a convenient summer standby. It is recommended that immersion elements should be thermostatically controlled and attention is drawn to the importance of properly arranging the circulation piping. It is suggested that a change-over switch should be fitted to prevent the simultaneous use of a heavily rated immersion heater and clothes wash boiler. Thermal-electric district heating is mentioned in general terms.

Appendix H is concerned with circuit wiring, including ring mains, but the latter should preferably not serve immersion heaters of more than 2·5 kW loading, or clothes wash boilers, or cookers, which should have separate circuits. Socket outlets for fused plugs should be of the same type throughout the building; not less than 5in above floor level and preferably 4ft 6in above the floor in kitchens and sculleries.

Appendix J discusses the influence of design considerations on general building costs. Numerous references are made throughout the volume to relevant British Standard specifications and to Codes of Practice, which are listed, together with a four-page bibliography of other publications mentioned in the several appendices of the manual.

Commerce and Industry

A.P.L.E. Conference Arrangements

British Water Resources

THE annual conference of the Association of Public Lighting Engineers will be held at Brighton from 18th to 21st September. The technical sessions will take place in The Dome, and in addition, delegates will have the opportunity of making an inspection of concrete and steel lamp columns with modern lanterns which will be erected along Madeira Drive for the period of the conference. It will not be possible to space the columns properly so the lanterns will not be lit. The customary indoor exhibition of public lighting equipment will not be held this year, but there will be a display of tower wagons, extending ladders, etc., also in Madeira Drive.

Mr. H. Pryce-Jones (South Eastern Electricity Board) will be inducted as president immediately before the official opening of the conference by Alderman Eric Simms, Mayor of Brighton, and at the annual luncheon on 20th September at the Hotel Metropole Lord Citrine will be the principal guest.

Inland Water Resources

The first report of the Inland Water Survey Committee to be published since the war has been issued by the Ministry of Local Government and Planning and the Scottish Office (H.M. Stationery Office, price 9d). The Committee recommends that surface water surveys should cover in some degree every part of the basin of all rivers with substantial water resources. The results obtained should, in the Committee's opinion, be published so that information would be readily available for judging any fresh scheme put forward for the utilization of water resources.

International Refrigeration Congress

A large number of technicians and industrialists are expected to attend the Eighth International Congress of Refrigeration which is to be held from 29th August to 11th September at Church House, Westminster.

The Governments of upwards of fifty countries are members of the International Institute of Refrigeration (L'Institut International du Froid) under whose auspices the Congress will be held, and the organizing body is the Institute of Refrigeration which, founded in 1900, is the oldest society of mechanical refrigeration in the world. Viscount Bruce of Melbourne, C.H., M.C., F.R.S., President of the Institute of Refrigeration, is also President of the Congress, together with Professor W. J. de Haas, who represents the International Institute. Particulars of the Congress can be obtained from the Secretary, International Congress of Refrigeration, Dalmeny House, Monument Street, London, E.C.3.

Light Fittings Schedule

Schedule No. 2 of the Electrical Fair Trading Policy (Electric Light Fittings—Ornamental and Decorative) has been amended. In the amended version discounts on fittings for fluorescent lamps are set out separately, in place of a footnote in the earlier schedule. Discounts on orders for individual fittings up to £50 in value in Category I are increased for special large buyers and recognized users. Copies of the amended schedule may be obtained from the Electrical Fair Trading Council, Sardinia House, Kingsway, London, W.C.2.

Norwich Industries Exhibition

A Norwich Industries Exhibition was held in connection with the recent Norwich Festival. The main purpose of the exhibition was to make Norwich people more aware of the importance of their local industries. Laurence, Scott & Electromotors, Ltd., had a stand on which some

The Lord Privy Seal and Mr. T. J. Barfield at the Norwich exhibition

winding and other manufacturing processes were carried out and there was a pictorial record of the company's history and activities. The other electrical exhibit was a stand by Heatrae, Ltd., on which a representative selection of that company's products appeared. The photograph shows Mr. T. J. Barfield (Laurence, Scott's publicity manager) with the Lord Privy Seal (Mr. R. R. Stokes), who opened the exhibition and earlier visited the Laurence,Scott works.

Restrictions on Cellulose Film

One result of the sulphur shortage is a reduction in the output of transparent cellulose film for wrapping purposes. Most of the supply of this film has to be conserved for the wrapping of goods for export and restrictions have been placed on the supply of film for a wide range of goods. Existing stocks may, however, be used up. Among the products affected by the restrictions are radio sets, valves, refrigerators, vacuum cleaners, irons, toasters, batteries, battery cases, torches, electric wire, lamps, insulating tape and washing machines.

Electricity Pension Regulations

The Electricity (Pension Rights) (Particular Schemes) Regulations, 1951 (S.I. 1951 No. 1079, H.M. Stationery Office, 2d) have been issued. They provide that the Northmet (Staff) Pension Fund shall remain undivided and shall be jointly administered by the British Electricity Authority and the Eastern Electricity Board. Members of the fund who are not in the employment of an Electricity Board are enabled to continue membership. The regulations also preserve the rights of former employees of Letchworth Electricity, Ltd., under the First Garden City Staff Benefit Society scheme.

Mine Lighting

The latest publication of the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, is a booklet on "Light and the Coal Miner." This well-printed and illustrated production opens with a brief treatise on the construction and operation of the eye and the circumstances in which it best functions. This information is then applied to conditions in mines and particulars are given of the design and application of lamps suitable for mine lighting.

Particular attention is paid to some specially designed fluorescent lamp fittings and to lighting for different purposes—coal face, haulage roads and coal picking. The benefits of good lighting—more and better coal, fewer accidents and better health and morale—are stressed.

The booklet can be obtained from the Bureau free of charge by anyone interested in the subject.

Indian Battery Market

A report in the *Indian Electrical Contractor and Trader* states that there are four factories in the country which manufacture dry batteries, the investment in three being Indian and the fourth foreign. Their output, however, is not sufficient to meet the demand. To encourage production there is a protective duty of 30 per cent *ad valorem* and other assistance is given in obtaining supplies of raw materials. Twelve factories produce the accumulator batteries, the total number made in 1950 being 187,123 against 107,065 in 1949 and 110,000 in 1948. Productive capacity is said to be considerably larger than this. The value of imported batteries (other than flashlight) rose from Rs 1,406,297 in 1948–49 to Rs 3,586,293 in 1949–50, but declined somewhat in the period April–November, 1950 (Rs 1,272,431).

Radio and Radar for Liner "Kenya"

Marconi Marine radio and radar equipment has been installed in the British India Steam Navigation Co.'s new 15,000 ton passenger liner *Kenya*.

Large Welsh Transformer

What is claimed to be the largest power transformer to be made in Wales up to the present time has just been completed by South Wales Switchgear, Ltd. The accompanying picture shows it passing through Monmouth in transit to a large colliery in N.E. England. This is a 3,000 kVA three-phase unit, having a no-load ratio of 11,000/3,300 V; it is equipped with oil conservator, radiator, Buchholz protective devices, h.v. trifurcating box, and l.v. four-gland box. The company is at the present time engaged in the

Large Welsh transformer *en route* to a North-Eastern colliery

Members of the Association of Mining Electrical and Mechanical Engineers at the Simplex works

manufacture of several similar transformers and has extended its range to 5,000 kVA, at voltages up to 11 kV, and 3,000 kVA at voltages up to 33 kV.

Evershed Overseas Representatives

Overseas representatives of Evershed & Vignoles, Ltd., visited the company's head office and works at Chiswick on 26th and 27th June for a conference and demonstration of the company's more recent developments. The visitors were welcomed by the joint managing directors, Mr. M. Vines and Mr. D. D. Walker. The representatives and their wives are the company's guests for a fortnight and a number of social events, etc., have been arranged for them.

Canadian Trade Fair

Among the exhibitors from this country at the recent Canadian International Trade Fair, Toronto, in addition to those mentioned in our 8th June issue, were Goodmans Industries, Ltd.

Mining Engineers' Visits

About seventy-five engineers, with their ladies, visited Tube Investments' factories at Oldbury, Birmingham, on 26th June, during the course of the annual convention of the Association of Mining Electrical and Mechanical Engineers at Malvern. At the Accles & Pollock sports ground at Birchley Crossings an exhibition marquee was set up covering every aspect of the Simplex business—switch and fuse gear, flameproof equipment, lighting fittings, Lundberg accessories, "Creda" domestic appliances, cookers, water heaters and heavy duty cooking equipment. After luncheon there were tours of the factories of Simplex Electric Co., Ltd., Tube Products, Ltd., and Accles & Pollock, Ltd. The ladies heard a talk on "Design in the Kitchen" given by Miss J. Whitgift, "Creda" housecraft adviser.

On the same day 200 members of the Association visited the Redditch works of Nife Batteries, Ltd., where they were entertained to luncheon.

About 250 members and ladies went to the Rugby works of the British Thomson-Houston Co., Ltd., on 27th June. At luncheon, at Chesford Grange, near Kenilworth, the visitors were welcomed by Mr. K. R. Hopkirk, B.T.H. director and chief mechanical engineer, and Mrs. Hopkirk.

On the same day a party visited the Witton works of the General Electric Co., Ltd., where they were welcomed by Dr. C. C. Garrard, resident director, and saw something of the production of heavy generating and transforming plant, flameproof equipment and switchgear, etc.

De La Rue Exhibition

The use of plastics in the electrical industry is a feature of an exhibition which until 19th July the De La Rue Organization is holding at 26, Conduit Street, London, W.1. Entering the electrical field shortly after the first world war with the development of a line telegraph insulator made from a material known as "Telenduron," the company went on to specialize in mouldings for almost every kind of electrical work, later turning to laminated and extruded plastics. Among the best known of the company's products are "Formica" decorative plastic with a top lamination of exceptional hardness; "Traffolyte," used extensively for signs and notices; and "Delaron," a laminated electrical insulating material, only half the weight of aluminium, also used for gearwheels.

Colour Television in America

By an eight to nil decision the United States Supreme Court recently upheld a Federal Court decision in favour of the Columbia Broadcasting System in the controversy with the Radio Corporation of America over colour television (the electronic method of the R.C.A. against the spinning disc of the C.B.S.). According to

Electrical World, Justice Black, in the written decision, said that in the light of previous experience it was thought that further delay in making colour available was too high a price to pay for a possible "compatible" system (one receivable on present sets), despite the R.C.A.'s claim that it was on the verge of discovering an acceptable system of this kind.

Refrigeration Industry

We regret that in our report of the discussion on Mr. E. G. Batt's paper at the Brighton Convention (29th June, pp. 1359–61) the photographs of Messrs. K. J. R. Cocke and E. G. Rowledge were changed over. Also Mr. Cocke points out that the diameter of the capillary tube to which he referred in his contribution to the discussion is 30 thousandths of an inch—not 1/30,000th as stated.

Sale of Gaiety Theatre

In the Chancery Division last week Mr. H. W. G. Lupino (Lupino Lane) applied to Mr. Justice Vaisey for an injunction restraining Crompton Parkinson, Ltd., from completing an agreement with the English Electric Co., Ltd., for the sale to the latter company of the Gaiety Theatre, London, of which Mr. Lupino is the mortgagor. Mr. Lupino is the plaintiff in an action concerning the sale of the property.

In refusing the injunction His Lordship said that in view of present building restrictions it was unlikely that permission would be secured for the demolition of the present damaged building and the erection of a new building for ten to fifteen years.

Change of Address

The offices of the South Western Electricity Consultative Council are now at Pearl Assurance House, High Street, Exeter (telephone: Exeter 2291).

Trade Announcements

The Electrical Apparatus Co., Ltd., St. Albans, is opening a branch office at 9, Camberley Road, Ipswich (telephone: Ipswich 77716) on 17th July, under the management of Mr. L. W. Postle, A.M.I.E.E., who has been with the company since 1937.

The **Supra Electrical Co., Ltd.**, the London wholesalers, have opened a depot at 23a, Berkeley Road, Tunbridge Wells (telephone No. 2721) under the management of Mr. W. W. Finlow. From this depot deliveries will be made over a wide area in Kent and Sussex.

The Manchester branch of the **Wholesale Fittings Co., Ltd.**, has recently been extended. This branch was established in 1313 at Shude Hill and has since shown steady progress necessitating removal in 1919 to larger premises at 78-80, High Street. The adjoining premises Nos. 82, 84, 86 & 88, have now been added. There is now direct access from the trade counter to an extensive ground floor showroom where modern and period fittings, radio and television sets, domestic appliances, etc., are effectively displayed. The first floor is reached by an impressive staircase where a wide range of fluorescent and industrial fittings are on view. Additional storage space for stock is now available.

The registered office of **Lancashire Dynamo Holdings, Ltd.**, is now 94, Petty France, London, S.W.1. The registered office of Lancashire Dynamo & Crypto (Mfg.), Ltd., is at the same address. As from 1st July this subsidiary company has been entirely responsible for the activities of the Trafford Park and Willesden Works.

Annual Holidays

The offices and works of E. K. Cole, Ltd., Southend, will be closed from after working hours on 27th July until 8th August.

British Insulated Callender's Cables, Ltd., announce the closing of their various works for the annual holidays as follows:—Prescot, Helsby, Huyton Quarry and Melling from 27th July to 11th August inclusive; Willenhall Foundry from 28th July to 11th August inclusive; Erith from 7th to 21st July inclusive; Anchor Works, Leigh, from 7th to 14th July and from 8th to 15th September inclusive. Skeleton staffs will be available to deal with urgent requirements.

Miniature Hearing Aid

On page 1387 of last week's issue we erroneously described the latest hearing aid to be introduced by John Bell & Croydon, 117, High Street, Oxford, as having two plug-in valves. It has three valves: two voltage amplifying pentodes and one output pentode.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £234 0s 0d
Fire Refined 99·7 per cent ..	ton £233 0s 0d
Fire Refined 99·2 per cent ..	ton £232 10s 0d
LEAD, English	ton £161 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £915 0s 0d
ZINC, G.O.B. Foreign	ton £160 0s 0d
Electrolytic	ton £164 0s 0d
BRASS Tubes	lb 2s 0½d
Sheet	lb 2s 3⅜d
Wire	lb 2s 6½d
COPPER Tubes	lb 2s 2⅝d
Sheet	ton £284 10s 0d
H.C. wire and strip	ton £261 15s 0d
PHOSPHOR BRONZE	
Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot ..	lb 44½d–45d

Industry and the House

The Ministry of Materials

By F. J. ERROLL, M.A., A.M.I.E.E., M.P.

THE increasing difficulty in obtaining supplies of raw materials has led the Government to form a Ministry of Materials. Since the war raw material supply has been in the hands of two Government Departments, the Board of Trade and the Ministry of Supply. When Mr. Stokes was appointed Lord Privy Seal it was made plain that one of his duties would be to supervise the supply of industrial raw materials. Whether or not the resignations of Mr. Aneurin Bevan and Mr. Harold Wilson affected the final decision still remains a secret, but in the end the Government decided that a new and additional Government Department was the only effective way of achieving the objective.

Advantage of Unified Control

On Wednesday last week the Lord Privy Seal introduced the Bill which will authorize the setting up of the Government Department of which he is to be the first Minister. In his opening speech he said that so far as was practicable all raw material questions would be dealt with in one Ministry instead of in several. The Bill would transfer certain functions from the Ministry of Supply and the Board of Trade. He had found when going to Washington that it was a great advantage for the person conducting the overseas negotiations to have the whole picture and be responsible for the whole range of raw materials.

He hoped too, with the assistance of the Chancellor of the Exchequer, to tackle the problem of the commodity price level. There was a serious fear of inflation on a wide scale and many commodity prices were at an extremely high level compared with twelve to eighteen months ago. He was determined not to build up another huge staff full of people whom industry had never seen before. He expected that over and above the transfers from other Departments there would not be more than a hundred additional persons. In general he would be responsible for the procurement of raw materials while existing Government Departments would continue to make allocations to individual industries and firms. There would, however, be one or two exceptions. The Ministry of Supply would continue to be responsible for the iron and steel industry as a whole and any attempt to distinguish between basic raw material and iron and steel at different stages in its fabrication would be artificial.

Mr. R. S. Hudson, a one-time Secretary for Overseas Trade, made out the Opposition case. He described it as a confession of the failure of existing machinery. It was far from clear whether this was the only alternative or indeed the best one. He saw in the Government's decision the Lord Privy Seal reduced to the level of a Departmental Minister — merely a "Strauss Junior." Mr. Hudson felt sure that the additional Department would create further contentions, lead to more inter-Departmental committees, and make the whole machinery of economic Government more cumbersome than it was.

American Consumption and Stock Piling

In the ensuing debate Members on both sides contributed useful suggestions. Mr. Bevan inquired if the Minister would have power of exploration for new minerals in this country if it was not done by private interests. Mr. Stokes assured him that he intended to tackle that job. Mr. Harold Wilson was critical of the Bill but agreed to its necessity because American consumption and stock piling so dominated the world situation. He claimed that we had reached a crisis in world capitalism and that the Minister would have to deal with the inability of the Americans to control their domestic consumption.

The Chancellor of the Exchequer concluded the debate. He sought to justify the setting up of a new Ministry on the grounds that a co-ordinating Minister alone would have had no power and would not even have had direct access to the officials

of other Ministries who were actually carrying out the decision to get materials. A co-ordinating Minister would have been in charge of the Ministers but would have been cut off from executive action. He referred finally to the importance of some form of price stability. There had been some encouraging signs in this matter. The United States commodity index had fallen nearly 10 per cent and there had been much sharper falls in wool, rubber and tin. " We do not, of course, want to run into a slump, and we do not want to get back to the frequently far too low levels of raw material prices that we had before the war which would have very serious consequences in the Colonies and in other parts of the world; but we do want to introduce a reasonable stability and to take hold of this most dangerous influence upon our economy at the source, with the help of our American friends." When the House divided the Government secured a majority of nineteen for the new Ministry.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons last week Mr. Ian Harvey asked the Minister of Fuel and Power whether he proposed to adopt a system of frequency-controlled load shedding along the lines of an invention which his department had investigated.

Mr. Noel-Baker said that the frequency relay apparatus in question had, he understood, been examined technically by the British Electricity Authority. It was one of a number of devices by which it might be technically possible to control peak loads. Experiments on other devices had already been made by the B.E.A. and more might be expected in the very near future. He could not say which particular device or devices might be adopted.

Recall of Colliery Electricians

The Minister of Labour informed Miss Jennie Lee that under present arrangements, which were provisional and subject to review, a colliery electrician might be recalled in an emergency but only if he was urgently required for service in a capacity for which his previous experience in the Forces made him specially suitable.

Scottish Electronic Development

Mr. Michael Stewart, on behalf of the Minister of Supply, told Mr. M. MacPherson that the Ministry of Supply and the Admiralty both needed more capacity for research and development work in electronics. The Government fully shared the desire of everyone in Scotland to see new industries set up there and they therefore welcomed the Scottish Council's proposals, supported by the Secretary of State for Scotland, that additional Government contracts for research and development work in electronics and for instrument making should be placed with experienced firms and that a considerable part of the work should be carried out, with the help and guidance of the parent firm, on sub-contract by firms who had not before done this kind of work. A start could now be made on the scheme, which would, of course, take time to develop fully. Ferranti, Ltd., who had been established in Edinburgh for some time, would be the first parent firm. They intended to add to the number of parent firms as experience was gained.

Allocation of Metals

Mr. Gaitskell, the Chancellor of the Exchequer, announced that the Government had been considering whether further steps were necessary to ensure that the distribution of steel and of non-ferrous metals was carried out in accordance with national requirements. In the case of steel, though production was not likely to be seriously below last year's record level, the demand was rising and this year's total requirements, including those of defence, were likely to exceed available supplies. The extent of the gap would vary according to the type of steel, and was not likely to exceed 10 per cent on the average, but if defence requirements and those of the most important civilian users were to be met in full, the shortage would be somewhat greater for other users. Sheet steel and tinplate were already subject to allocation; in the circumstances the Government had decided that full allocation schemes must now be prepared for all other types of steel.

As regards non-ferrous metals there was a serious shortage of copper and zinc. The use of these metals and their alloys for unessential purposes was prohibited some months ago, and an informal control over distribution established. The Government had now decided that in the

use of copper, zinc, and their alloys, arrangements for the closer control of distribution were also necessary and should be prepared. It would be some time before these allocation schemes could come into full operation and certain interim measures had been devised.

In a circulated statement giving fuller details, Mr. Gaitskell said it was proposed to use a "Defence Order" (D.O.) symbol which could be applied, by Government decision, to orders for specialized defence equipment or work and a "Preferential Treatment" (P.T.) symbol for various categories of civilian production, including dollar and sterling area exports and the fuel and power programmes, which remained as important as ever. Proposals were being worked out whereby sponsoring Departments would be able to claim preferential treatment for specific orders for goods for which iron, steel (other than those already allocated) and copper, zinc and their alloys were required, subject to a strict limit on the amount qualifying for such preferential treatment in any particular period.

At a Press conference the Minister of Supply (Mr. Strauss) emphasized that the proposals did not mean that there was any deterioration in the raw materials situation; indeed, the Government hoped that, as a result of discussions in Washington, there would be fairer international distribution in future, but there would be shortages for some time. Industry was anxious for some guidance about preference and for a method of identifying defence orders. There would be no statutory enforcement; it was felt that the necessary co-operation would be given by the suppliers.

Coal Supplies

Replying to Mr. Nabarro on the question of coal allocations, the Minister of Fuel and Power (Mr. Noel-Baker) said the following were the figures for coal supplied in the coal year 1950–51 in millions of tons:—Power stations, 34; railways, 14; gas works, 27; coke ovens, 24; industry, 46; exports and bunkers, 13; house coal and boiler fuel, 33.

Electricity Supply Industry

PRELIMINARY Report No. 155 on the Census of Production (*Board of Trade Journal*, 7th July) covers the electricity supply industry. The figures for 1948 are compared with those for 1935. Separate particulars are given of the nationalized industry (B.E.A. and Electricity Boards) and the North of Scotland (the Hydro-Electric Board and the Lochaber Power Co.) and the "rest of the industry"—establishments of transport authorities producing electricity mainly for the use of the parent undertakings and certain other undertakings which have not been nationalized. The majority of industrial electricity undertakings have been excluded but a few establishments having a substantial commercial sale of electricity are covered. It is noted that in 1935 undertakings in Northern Ireland (excluded from the 1948 figures) accounted for about 1 per cent of the net output of the United Kingdom.

The salient figures are given in a general summary which is reproduced herewith.

The "value of production" includes electricity sold to customers (£198·7 million in 1948 and £71·7 million in 1935), sale of waste and by-products, rents received, net receipts from sales of appliances, work done for consumers and directly charged and work of new construction.

Capital expenditure in 1948 on new plant, machinery, vehicles and appliances for hire was about £67 million, plus £119,000 of second-hand equipment.

One table analyses employment, wages and salaries for operatives and administrative, technical and clerical staff for 1948.

	1948			1935
	British Electricity Authority and North of Scotland	Other	Total (*a*)	(*a*)
	£(000)	£(000)	£(000)	£(000)
Value of production (gross output)	232,950	8,769	241,719	86,416
Cost of materials, fuel and electricity used (*b*)	98,805	5,829	104,634	23,579
Net output	134,145	2,940	137,085	62,837
Wages and salaries of persons employed	50,549	1,473	52,022	..
	No.	No.	No.	No.
Average number of persons employed	146,541	3,868	150,409	102,480
	£	£	£	£
Net output per person employed	915	760	911	613
	No.	No.	No.	No.
Number of generating stations	339	21(*c*)	..	605(*c*)

(*a*) Great Britain only. (*b*) Purchased from outside sources.
(*c*) Number of establishments.

Information at the Festival

From a Correspondent

A LITTLE-KNOWN feature of the Festival of Britain is the industrial information unit at the South Bank. Known as " Design Review " it constitutes the most up-to-date illustrated reference service in existence of British achievement in industry. The Stock List has been transformed into something more presentable for visitors. Electrical equipment of all kinds—domestic and industrial—is well represented not only on file cards but also by lantern slides which are projected on to frosted screens for easy inspection.

Design Review is a public display freely open to all South Bank visitors during certain hours. Primarily, however, it is intended for visitors with special interests, such as industrial executives and trade buyers, who will be able to examine photographs and information sheets in detail, and at their leisure. Seven arches under Waterloo Bridge have been converted into an entrance hall, five information bureaux, each dealing with a related group of industries, and a display of British textiles. Each bureau, in addition to its other records, contains a modest library of the British trade and technical journals appropriate to the industries covered. This part of the arrangement is actually rather weak compared with the excellence of the rest of the service. A small staff of interpreters and secretaries is on call.

Up-to-date Records

This small unit supplements the trade information bureaux established throughout the South Bank Exhibition which are attached to appropriate pavilions. Constant addition and revision will ensure that records are up-to-date, and that a high standard is maintained. Manufacturers can continue to submit items for Design Review although the Festival is now in progress.

In each section of Design Review specially trained assistants provide a continuous information service between 11 a.m. and 7 p.m. daily. Thus electrical queries will be dealt with in the Engineering Section. On request the staff can produce from index cabinets any required photographs or samples with full information and descriptive matter, including the manufacturer's name and address, designer's name (when available), model number and salient design points. The last useful feature may draw attention to methods of construction, materials used, finish, mechanism and so on. A space has been provided for giving approximate retail price, exclusive of purchase tax, but this has understandably been little used.

Helping Export Trade

This very creditable enterprise might well live on after the Exhibition has passed its allotted span. Particularly to overseas visitors and buyers, it must be of immense value in reducing the difficulties of finding particular items, with corresponding benefit to our export trade.

New Switchgear Factory

THE rapidly increasing demand for Foster transformers, voltage regulators, specialized test equipment and switchgear, has brought about a situation where it has become impossible to deal with the volume of orders at the Wimbledon factory of Foster Transformers & Switchgear, Ltd. (a company in the Lancashire Dynamo group). To cope with this situation, arrangements have been made to transfer production of Foster switchgear to Crypton Equipment, Ltd., another factory in the L.D.C. organization. This newly-built factory is at Bridgwater, Somerset, on a seven acre site and can provide the increased production space which these developments demand and can also offer scope for factory extensions.

The design and production of switchgear at Bridgwater will be carried on by the same staff as previously employed at Wimbledon. New equipment and tools are being installed which, together with the increased space available, will enable a higher production to be built up, thus ensuring the best possible delivery service.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Tube Investments, Ltd., announce that the consideration payable to Stewarts & Lloyds, Ltd., for the cancellation of the special rights attaching to the liaison shares held by Tube Investments, Ltd., and Stewarts & Lloyds, Ltd., has been agreed at £650,000. Shareholders will be notified shortly of the arrangements for carrying these terms into effect, which will result in the 500 liaison shares in Tube Investments, Ltd., being converted into 500 ordinary shares as from 14th February last.

T. Clarke & Co., Ltd.—Addressing the annual general meeting on 28th June, Major D. Eric Smith, the chairman, drew attention to the fact that work in progress stood at £535,120, which represented an increase of over 100 per cent compared with the previous year. No profit had been taken into account on this work in progress which the directors thought would be remunerative. They hoped that dividends would be maintained.

Ward & Goldstone, Ltd., report that after all charges, including tax, the profit for the year ended 31st March was £200,631 (£143,166). A final dividend of 25 per cent is to be paid, making 45 per cent for the year on a capital raised by a 25 per cent share bonus. In the previous year there was an interim dividend of 20 per cent on the smaller capital and a final dividend of 24 per cent on the larger. It is proposed to make a bonus distribution of one 5s ordinary share for every ten units held.

W. T. Henley's Telegraph Works Co., Ltd.—At the annual general meeting on 29th June, Sir Montague Hughman, the chairman, said that they were faced throughout the year with many difficulties. It was a period of steeply rising costs and frequent price adjustments; competition during the first half of the year was extremely keen in every department of their business at home and abroad. Overseas business as a whole was not quite so good as in 1949, representing a little under 40 per cent of their total turnover. The results were nevertheless satisfactory.

Johnson, Matthey & Co., Ltd., are to increase their final dividend from 9 to 12 per cent, making 15 per cent (12 per cent) for the year ended 31st March. After taxation of £771,245, the net group profit was £622,175, compared with £897,366. The proportion of the group profit attributable to the holding company was £559,045 (£853,481). Dividends will absorb £44,831 (£38,619). Subject to the consent of the Treasury, and to an increase in the authorized share capital, it is proposed in the near future to make an issue of ordinary shares by way of rights to ordinary shareholders and loan stockholders.

The Revo Electric Co., Ltd., reports that, after providing nil (£17,500) for general reserve, £40,000 (same) for plant replacement, £25,000 (nil) for stock contingencies reserve, £53,517 (£55,585) for dividend and cash bonus, there remains £152,076 (£148,830) to be carried forward. Provisions for tax do not include additional profits tax which would be payable in the event of a subsequent distribution of retained profits and which would amount to approximately £166,000 (£121,500) before providing for such income tax relief as may be obtainable thereon.

Aerialite, Ltd., announces that 60,000 new 6 per cent cumulative redeemable preference shares will be subscribed for by Singer and Friedlander at par and that 300,000 new 1s ordinary shares will be offered to ordinary shareholders in the proportion of one for four at 4s. A second interim dividend of 55 per cent makes 88½ per cent to date on capital increased by share bonus of 87½ per cent. Last year there was one interim dividend of 62½ per cent on smaller capital followed by a final dividend of 50 per cent on larger capital.

Scottish Cables, Ltd., are to maintain their final dividend at 20 per cent, again making 30 per cent for the year. The trading profit for the year ended 30th April was £274,561 (£273,901). Tax absorbed £143,700 (£134,040) and depreciation and auditors' remuneration £24,656 (£24,506). Additional tax for the previous year required £5,200 (nil) and general reserve receives £45,000 (£65,606). The carry-forward is increased from £21,730 to £25,606.

The Electric Construction Co., Ltd., reports a net profit of £97,369 for the year ended 31st March last, compared with £95,120 in the previous year. These figures were arrived at after providing for taxation of £124,708 and £133,753 respectively. The proposed dividend of 15 per cent compares with 12½ per cent plus a bonus of 2½ per cent for 1949-50.

Ada (Halifax), Ltd., reports a group profit of £217,280 and a net profit of £88,795 for 1950.

The sum of £130,785, the pre-requisition profit of a subsidiary, is transferred to capital reserve. A final dividend of 5 per cent actual for the five months since the company was made public in December makes a total of 10 per cent actual (against 8⅓ per cent forecast in the information statement), being at the rate of 25 per cent per annum.

W. & T. Avery, Ltd.—After providing for all charges, including taxation amounting to £882,621 (£752,201), the group profit for the year ended 31st March was £611,694 (£557,202). The final dividend is increased from 15 to 20 per cent to make a total distribution for the year of 25 per cent (20 per cent).

Hoover, Ltd., is paying an interim dividend of 10 per cent. The directors point out that, although this compares with the equivalent of 7½ per cent last year, the increase has been made with a view to reducing the disparity between the interim and final dividends, and should not be regarded as an indication that the dividend for the year will be increased.

London Electric Wire Co. & Smiths, Ltd.—Speaking at the annual general meeting on 27th June Mr. W. J. Terry, chairman and managing director, said that shortage of raw materials generally was causing great embarrassment and with the reduced supplies at present envisaged it would not be possible to maintain last year's rate of output.

Telephone Properties, Ltd., which are controlled by the Telephone & General Trust, Ltd., show an income last year of £124,196 (£95,964) and a net profit, after tax, of £57,018 (£36,612). Contingencies reserve receives £20,000 (£7,128) and the dividend is raised from 7 to 8 per cent, leaving £39,661 (£32,597) to be carried forward.

The Telegraph Construction & Maintenance Co., Ltd., is to pay an interim dividend of 5 per cent actual (same).

J. & E. Hall, Ltd., are maintaining their interim dividend at 2½ per cent.

New Companies

Simmonds & Stokes (Niphan), Ltd.—Registered 22nd June. Capital £50,000. To acquire the whole or any part of the undertaking, assets and liabilities of Simmonds & Stokes, Ltd. (in voluntary liquidation); and to carry on the business of electricians, mechanical engineers, etc. Directors: B. S. Simmonds, F. V. Mellows, E. A. Mills and W. C. James. Secretary: G. G. P. Richardson. Regd. office: Victoria House, Southampton Row, W.C.1.

Wholesale Electrical Supplies (Hendrons), Ltd.—Registered in Belfast 15th May. Capital £10,000. Directors: F. Hendron, T. Hendron and H. Hendron. Office: 8/16, Eliza Street, Belfast.

Esher Electrical Services, Ltd.—Registered 22nd May. Capital £100. Electrical engineers and general electrical installation contractors, wireless engineers and service agents, etc. Mrs. Jessie E. Freeland is first and permanent director. Regd. office: Empire House, St. Martin's-le-Grand, E.C.1.

Winding-up Orders

Gordon Refrigeration Co., Ltd., 157, Westbourne Grove, London, W.11.—Winding-up order made 25th June.

Ribec Battery Co., Ltd., Magdalene Street, Glastonbury.—Winding-up order made 25th June.

Meeting of Creditors

Sherborne Electrical Co., Ltd.—A meeting of creditors is to be held at the offices of Cozens Bate & Co., Ltd., 25, Baldwin Street, Bristol, on 18th July.

Liquidations

Richard Crittall (Industrial Plant & Equipment), Ltd.—Meeting of members and creditors, 31st July, at Room C, Chartered Accountants' Halls, 220, St. Vincent Street, Glasgow, C.2, to hear an account of the winding-up by the liquidator, Mr. W. Walker.

Simmonds & Stokes, Ltd., electrical engineers, Victoria House, Southampton Row, London.—Winding up voluntarily. Liquidator, Mr. H. Moore, 30, Cornhill, London. (See "New Companies" section.)

Strong Illuminating Engineering Co., Ltd.—Claims to the liquidator, Mr. L. B. Blackler, Imperial House, Dominion Street, London, E.C.2, by 17th July.

Harrison & Co. (Electrical), Ltd., wireless and electrical factors, 6, Broad Street Place, London, E.C.2.—First and final dividend of 2s in the £ payable 11th July at the offices of the liquidator, Mr. A. E. Attwood, 20-21, Lawrence Lane, Cheapside, London.

Bankruptcies

G. C. Higgins, electrical engineer, 8, Carlton Road, Whalley Range, Manchester.—Receiving order made 25th June on a creditor's petition.

S. Edmondson, electrical dealer and contractor, carrying on business at Main Street, Milnthorpe, Westmorland, as E. & B. Radio.—First meeting 10th July at Mr. Temple's office, 31, Stramongate, Kendal. Public examination 23rd July at the County Court Offices, 48, Stramongate, Kendal.

D. Cromwell and **V. I. Cromwell**, trading as Cromwell & Co., Hindsley Works, Hindsley Place, Forest Hill, London, S.E.23, electrical fittings and lampshade manufacturers.—Receiving order made 22nd June on a creditor's petition.

STOCKS and SHARES

WHAT was ironically called the "threat of peace" had a marked effect upon Stock Exchange prices at the beginning of the week. Too much reliance was not placed upon the approach of the North Korean and Chinese field commanders in their acceptance of the proposal for a cease-fire conference, but the mere fact of there being any approach at all was regarded as a hopeful sign for early termination of the war. In consequence, prices in most investment departments improved, though the sections dealing with war material—base metals for instance—took on a dull appearance and prices went back. The position is still one of doubt, and, until something more realistic emerges from the present uncertainty, it is not likely that there will be any noticeable return of activity to Stock Exchange markets. In the meantime, however, prices keep firm in most groups, the recovery being marked principally in the British Government and similar gilt-edged securities.

Cable Results

Scottish Cables 4s ordinary shares remained steady at 26s following the decision to maintain the dividend for the year at the rate of 30 per cent paid since the war. Trading profit is reported to be virtually unchanged, and the net figure is slightly down on account of a larger tax liability. The shares pay £4 12s 6d per cent on the money. At the Enfield Cables meeting, the chairman described the change which came over business in the middle of the year as a result of the Korean war, and the difficulties of meeting a much larger volume of orders in the face of the raw material shortages. The company raised £1,250,000 in 4 per cent debentures earlier this year, but is again having to consider the question of another increase in the permanent capital.

Electric Construction

This company's £1 ordinary shares, at 68s 9d, are 2s to the good on balance over the past month, after having changed hands up to 72s in front of the final dividend declared for the year ended in March. According to the preliminary figures, net taxed profits were well maintained at the much higher level reported a year ago, and the 2½ per cent bonus added on that occasion to the previously regular 12½ per cent payments is consolidated this time into the dividend. On the total of 15 per cent the shares pay £4 7s 3d per cent on the money, and the distribution appears to be covered three to four times by available earnings.

Cossor Progress

A. C. Cossor's financial year also ended three months ago, when the board made a statement, based on preliminary figures, to the effect that profits would be sufficient to cover the debit carried forward from previous years and a payment on account of the preference dividend arrears. One year's preference dividend was duly distributed, bringing payments up to March, 1949. Pending the actual figures, which did not appear last time until September, the 5s shares have been subject to fairly wide fluctuations, the extremes this year being 11s to 16s; the present price is 14s 3d and the 6 per cent preference stand at just over par.

Ekco Dividends

Apart from the G.E.C. results, which came out last time towards the end of July, interesting events expected this month include the final dividend and results of the E. K. Cole company. Last year's final was 12 per cent, making a total of 20 per cent for the year, and was well on the conservative side. In the course of the year ended last March, the company secured its new financial requirements by a private placing of £400,000 loan stock, and subsequently raised the interim dividend from 8 to 10 per cent. On the former rate the 5s shares at 23s show a yield of under 4½ per cent, which suggests that the market is entertaining moderate expectations in connection with the coming results.

Aerialite Issue

Aerialite, Ltd., are raising new capital by the issue of 60,000 6 per cent preference shares and by the offer of 300,000 new 1s ordinary shares at 4s to existing holders, in the proportion of one-for-four. Preliminary notice of an issue appeared earlier, and had been anticipated in view of the overdraft of over £100,000 which appeared in the last balance sheet. With the present shares standing at 8s 9d, rights to the new are worth a shade under 1s per share. Issues of a similar character are to be proposed by the Rheostatic company at a meeting to be held on 9th July.

Month's Price Changes

It will be noticed from the price fluctuations in the month of June given on the next page, that the rises outnumber the falls, and that some of the gains are substantial. For instance, Anglo-American Telegraph preferred is 17 points up, Reyrolle have risen nearly 10s and Parsons 7s 6d, while Automatic Telephone & Chloride Electrical are better to the extent of 3s 3d and 3s 9d respectively. Johnson & Phillips and Siemens have both gone ahead. Aron, Hoover, Midland Electric and De la Rue are all 2s 6d to the good. On the other hand, the spasm of weakness which overtook markets on the grave aspect of the Persian oil position led to falls in Associated Electrical Industries, English Electric, Ever Ready and Tube Investments.

Electrical Investments

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price June 29 1951	Month's Rise or Fall	Yield £ s. d.
Overseas Electricity Companies					
Atlas Elec. ..	3	4	21/-	+2/-	3 16 2
Calcutta Elec. ..	6†	6†	22/6	−$\frac{1}{16}$	5 6 8†
Cawnpore Elec. ..	—	—	32/6	+$\frac{1}{16}$	Nil
East African Power	7	7	39/6	+9d	3 11 0
Jerusalem Elec. ..	—	—	10/-	−$\frac{1}{16}$	Nil
Madras Elec. ..	—	—	31/-	—	Nil
Nigerian Elec. ..	10	10	28/9	−$\frac{1}{2}$	6 19 2
Palestine Elec. "A"	5†	5†	19/-	−6d	5 5 3†
Perak Hydro-Elec.	Nil	Nil	12/6	—	Nil
Whitehall Inv. Pref.	6	6	22/6	—	5 6 8
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	13/9	−9d	7 5 6
Aron Elec. Ord. ..	15	15	42/6	+$\frac{1}{2}$	7 1 2
Assoc. Elec. Ord.	15	20	95/-	−$\frac{1}{2}$	4 4 2
Automatic Tel.&El.	12$\frac{1}{2}$	15	73/9	+3/3	4 1 1
Babcock & Wilcox	15	18	80/-	—	4 10 0
Baldwin, H. J.(2/-)	25	25	5/9	+3d	8 14 0
British Aluminium	10	10	45/-	—	4 9 0
B.I. Callender's ..	6$\frac{2}{3}$	7$\frac{1}{2}$	36/-	−1/-	4 3 4
British Thermostat (5/-)	30	30	35/-	+6d	4 6 2
British Vac.Cleaner (5/-)	20	25	14/9	+9d	8 9 6
Brush Ord. (5/-) ..	10	10	6/9	−3d	7 8 2
Burco (5/-) ..	35	42$\frac{1}{2}$	23/9	+6d	8 19 0
Chloride El.Storage	12$\frac{1}{2}$	15	73/9	+$\frac{1}{16}$	4 1 7
Cole, E. K. (5/-) ..	20	20	22/6	−6d	4 9 0
Cossor, A. C. (5/-)	Nil	Nil	14/3	—	Nil
Crabtree (10/-) ..	17$\frac{1}{2}$	17$\frac{1}{2}$	43/-	—	4 1 5
Crompton Parkinson Ord. (5/-) ..	22$\frac{1}{2}$	11$\frac{1}{4}$*	12/-	−1/-	4 13 9
De La Rue (5/-) ..	50	50	37/6	+$\frac{1}{2}$	6 13 4
Decca (1/-) ..	112$\frac{1}{2}$	112$\frac{1}{2}$	22/6	−1/-	5 0 0
E.M.I. (10/-) ..	8	8	21/3	—	3 15 3
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	15	15	68/9	+2/-	4 7 3
Enfield Cable Ord.	7$\frac{1}{2}$	7$\frac{1}{2}$	33/6	—	4 9 7
English Electric ..	10	15	70/-	−$\frac{1}{2}$	4 5 9
Ericsson Tel. (5/-)	20†	22†*	53/9	—	2 1 0†
Ever Ready (5/-)..	35	35	30/6	−$\frac{1}{2}$	5 14 9
Falk Stadelmann	15	15	46/3	—	6 10 0
G.E.C. Ord. ..	17$\frac{1}{2}$	17$\frac{1}{2}$	93/9	+$\frac{1}{16}$	3 14 6
General Cables (5/-)	38	30*	17/6	—	6 11 6
Greenwood & Batley	15	15	55/-	—	5 9 1
Hackbridge Cable (5/-)	—	20	15/3	+6d	6 11 2
HackbridgeHewittic (5/-)	15	18	17/6	—	5 2 9
Hall Tel. Acc. (10/-)	10	10	14/-	−1/-	7 2 10
Heatrae (2/-) ..	12$\frac{1}{2}$	12$\frac{1}{2}$	4/-	—	6 5 0
Henleys (5/-) ..	20	20	24/6	+6d	4 1 8
Hoover (5/-) ..	45	30*	33/9	+2/6	4 9 2
Intl. Combustion (5/-)	21	20*	23/6	+6d	4 5 1
Johnson & Phillips	15	15	63/9	+3/-	4 14 4

Company	Dividend Previous	Dividend Last	Middle Price June 29 1951	Month's Rise or Fall	Yield £ s. d.
Equipment and Manufacturing (continued)					
Lancashire Dynamo	22$\frac{1}{2}$	22$\frac{1}{2}$	5$\frac{1}{2}$	—	4 1 10
Laurence,Scott(5/-)	12$\frac{1}{2}$	12$\frac{1}{2}$	14/3	−6d	4 7 9
London Elec. Wire	10	10	50/9	−6d	3 18 9
J. Lucas	17$\frac{1}{2}$	6$\frac{2}{3}$*	43/9	+6d	3 1 0
Mather & Platt ..	11	12$\frac{1}{2}$	49/6	—	5 0 10
Metal Industries ..	10	10	45/6	—	4 8 0
Mid. Elec. Mfg. ..	12$\frac{1}{2}$	15	65/-	+$\frac{1}{2}$	4 12 3
Murex	20	10*	57/6	+6d	3 9 6
Newman Ind. (2/-)	10	6	3/3	+3d	3 14 0
Oldham & Son (1/-)	60	30*	5/-	—	6 0 0
Parsons, C. A. ..	15	15	105/-	+7/6	2 17 2
Plessey (5/-) ..	20	20	21/3	—	4 14 1
Pye Deferred (5/-)	35	18*	22/6	—	4 0 0
Radio & Tel. (2/-)	—	—	9d	—	Nil
Revo (10/-) ..	27$\frac{1}{2}$	27$\frac{1}{2}$	47/-	—	5 17 0
Reyrolle	15	15	93/9	+9/3	3 4 0
Scophony Baird(1/-)	—	—	1/4$\frac{1}{2}$	—	Nil
Scot. Cable (4/-) ..	30	30	26/-	−6d	4 12 4
Siemens Ord. ..	7$\frac{1}{2}$	10	43/9	+3/9	4 11 0
Switchgear&Cowans (5/-)	20	22$\frac{1}{2}$	17/6	+$\frac{1}{16}$	6 8 7
T.C.C. (10/-) ..	15	20	37/6	+$\frac{1}{2}$	5 6 8
T.C. & M. ..	9*	10*	46/-	—	4 7 0
Telephone Mfg.(5/-)	9	10	11/6	—	4 7 0
Thorn Elec. (5/-)..	20	20	9/6	—	5 5 3
Tube Investments	25	25	6$\frac{1}{4}$	−$\frac{1}{2}$	3 14 5
Vactric (5/-) ..	Nil	Nil	13/9	+$\frac{1}{2}$	Nil
Veritys (5/-) ..	5	2$\frac{1}{2}$	3/6	—	7 2 10
Walsall Conduits (4/-)	70	70	62/6	—	4 9 6
Ward & Goldstone (5/-)	44	45*	50/-	+6/-	4 10 0
Watford (2/-) ..	20	25	7/6	−6d	6 13 4
Westinghouse Brake	14	14	61/3	—	4 11 6
West, Allen (5/-)..	10	12$\frac{1}{2}$	12/6	+6d	5 0 0
Transport and Communications					
Anglo-Am. Tel.: Pref.	5$\frac{13}{20}$	5$\frac{16}{20}$	95/-	+17	6 2 2
Def.	—	—	22$\frac{3}{4}$	+5	Nil
Anglo-Portuguese	8	8	24/-	−2/-	6 13 4
Brit. Elec. Traction: Def. Ord. ..	22$\frac{1}{2}$	25	515	−20	4 17 0
Cable & Wireless: Ord.	—	6	125$\frac{1}{2}$	−2	4 15 7
4 % Loan ..	4	4	100	—	4 0 0
Calcutta Trams ..	6†	6†	26/3	−6d	—
Cape Elec. Trams	6	4	16/-	—	—
Globe Tel. & Tel. Ord.	—	—	25/-	—	—
Great Northern Tel. (£10)	7$\frac{1}{2}$	8	12	−$\frac{1}{2}$	6 13 4
Inter. Tel. & Tel.	Nil	15cts	30$\frac{1}{2}$	−$\frac{1}{2}$	—
Marconi Marine ..	7$\frac{1}{2}$	10	35/-	−1/6	5 14 3
Oriental Tel. Ord.	16	16	52/6	−$\frac{1}{4}$	6 2 2
Telephone Props.	7	8	27/6	+$\frac{1}{4}$	5 16 6
Tele. Rentals (5/-)	10	10	11/9	+1/-	4 5 1

* After capital bonus.
† Dividends are paid free of Income Tax.

ELECTRICITY SUPPLY

Woolwich Power Station Extension

CONSENT to the extension of Woolwich power station has been received from the Minister of Fuel and Power by the British Electricity Authority. The extension comprises one 30 MW turbo-alternator and two 180,000 lb/hr boilers, which will bring the total installed capacity of the station up to about 133 MW.

House Installations at Dudley

Dudley Town Council is to have electric lighting and power points installed in the following existing houses :—Woodside Estate (34 houses), Wolverton Road site (257), Northfield Road/Cradley Road (86), Priory Estate (177), Fox Yards (142), Wrens Nest (248), and Wrens Nest (244).

Shoreham Harbour Extension

In the annual report of the Shoreham harbourmaster presented to the Trustees last week it is intimated that construction work at the harbour is expected to be started towards the end of the year. The British Electricity Authority, it is stated, requires the scheme to be sufficiently far advanced by the summer of 1953 for the Authority's new and larger vessels to use the port.

Installation Scheme Shelved

Sunderland Corporation Estates Committee has decided not to take any further action regarding a £25,700 scheme for supplying electricity to 358 houses served only with gas at Southwick. The Committee decided that the diverting of materials for this scheme would lead to a slowing down in the completion of new dwellings.

Street Lighting in Singapore

The Singapore Municipal Commissioners have approved in principle a second five-year electric street lighting programme involving the installation of some 4,000 lamps. The annual cost is approximately $300,000 (£35,000).

Refrigerator Plan Deferred

At a meeting of Shipley Urban District Council last week it was decided to defer for twelve months consideration of a scheme to provide refrigerators in Council houses when requested by the tenants. This action was taken because of the increased purchase tax. It was reported to the Council last December that 103 tenants had asked for refrigerators to be installed on the terms specified. Mr. J. N. Oxley, treasurer and accountant to the Council, said that the original cost of a refrigerator was £26 13s, including £6 13s 3d purchase tax, but the present cost was £35 15s, including £14 6s purchase tax. The cost of a cabinet and other installation charges brought the price to £42 5s.

A representative of the firm supplying the refrigerators when asked why the facility should not have been offered to all ratepayers said that a Ministry restriction permitted them to manufacture for home consumption on the understanding that the refrigerators were not for sale in the open market.

Generation in South Africa

According to the South African Department of Census and Statistics, 10,867·3 million kWh was generated in the Union last year (by authorities representing some 95 per cent of the country's total output). This compares with 9,919·4 million kWh in 1949, an increase of 9·3 per cent.

Victorian Power Shortage

New restrictions imposed by the Victorian State Electricity Commission include an extension of the period during which space heating is banned to 7.30 p.m. (previously 5 p.m.). Consumption by domestic and commercial users (excluding farming and mining) must be kept to within 90 per cent of that in the corresponding period of last year. For new users the Commission is to establish a quota and issue a certificate indicating the amount that may be used.

Large Pumps

To lift water from Lake Roosevelt to the Columbia Basin project six pumps are being installed at Grand Coulee and the first of these was scheduled to begin operation recently, states *Electrical West*. They are single-stage centrifugal units each driven by a 65,000 h.p. synchronous motor (60 c/s, three-phase, 13,600 V, 200 r.p.m.) and will lift more than 1,000 million gallons of water a day 280ft into a distribution system that will eventually irrigate a million acres of land in central Washington. The 30-ton cast steel impellers are nearly 14ft in diameter.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Television Picture Tubes

TWO new 12in television picture tubes with aluminized screens introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, differ from the earlier 12in tubes in that the screen face is much flatter (radius of curvature 700 mm) and they can be used at h.t. voltages up to 10,000, against the previous maximum of 8,000.

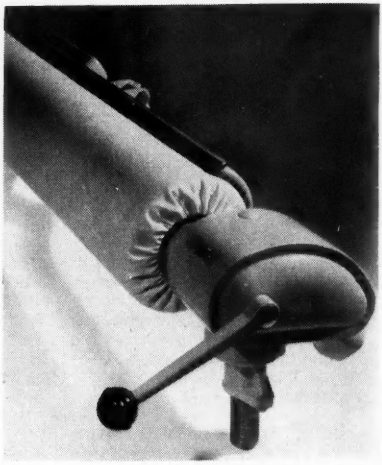
The screen colour is white and the list price of both types of tube is £12 15s 0d plus £6 12s 8d purchase tax. Type 6705A has a 6·3 V, 0·5 A heater and type 6706A a 10·8 V, 0·3 A heater.

Rotary Ironer

The model "R.L." rotary ironer introduced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, follows the essential points of its predecessors in that it is powered by the Hotpoint washing machine and mounted in the place normally occupied by the wringer, and it retains the 26in long blanket roll with a stainless steel faced shoe.

The new machine has a cast alloy gearbox with easily cleaned surfaces and thermostatic control has been provided. It is finished in stoved synthetic enamel to match the washing machine. With a shoe loading of 1,200 W the ironer is ready for use within five minutes from switching on. Ten feet of asbestos insulated braided cable is supplied.

Alternative support pillars and drive couplings make the ironer suitable for certain other makes of washing machine. The list price is £21 (plus £10 18s 5d P.T. in this country).



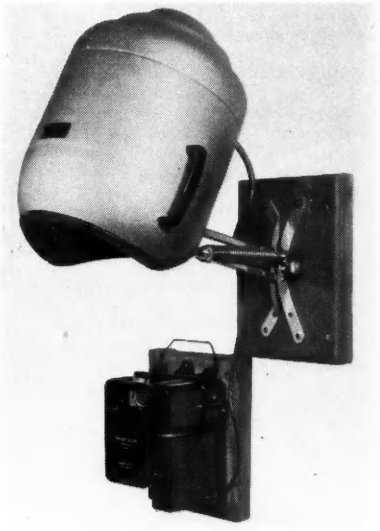
Hotpoint "R.L." rotary ironer

Automatic Hair Dryer

An automatic hair dryer suitable for use in swimming baths, hospitals, nurses' homes, etc., has been produced by OSBORNE, GARRETT & CO., LTD., 51–55, Frith Street, London, W.1. It incorporates an insulated moulded interior hood and a fixed rate collector or prepayment meter. The motor is of the brushless induction a.c. type fitted with silent ball bearings and causing no interference with radio or television. The robust spiral type heating elements have a loading of just under 1 kW.

The apparatus is finished in hammered "Dimenso" enamel with Bakelite parts in black and a plated counterpoise bracket movement. Complete with bracket, the dryer costs £24 (plus £8 P.T. in this country). A Sangamo fixed rate collector can be supplied at £6 10s or a Venner prepayment switch at £9 7s.

Automatic hair dryer



Engineering in Europe

Survey of Current Literature

NOTWITHSTANDING the building of more generating stations and the strengthening of transmission systems, the power famine seems to be increasing in many parts of the world. Yet it is still true that the "simultaneity coefficient" of industrial systems is very low, so that the average loading factor, even under peak conditions, is only about 55 per cent, corresponding to a cos $\phi \cong 70$ per cent. Metallurgical furnaces work at a cos $\phi = 0{\cdot}4$–$0{\cdot}5$; fluorescent lighting at cos $\phi = 0{\cdot}3$–$0{\cdot}5$. The use of synchronous motors raises the average of cos ϕ to about 0·70, and in low and medium voltage systems to 0·6–0·65.

This article deals with the production and "transport" of reactive power, including the additional losses connected therewith (investment and running losses), basing the economic evaluation on the actual figures for 1949 of the reconstructed production and transmission plant of the power companies attached to the Belgian grid; hence the question of voltage stability and its connection with the problem of compensation is considered with its bearing on the reserve and production of the kVAr. After a very full discussion of these economic premises, the technical side of static capacitor compensation is treated more briefly.—"Some Aspects of the Compensation of Reactive Power by Static Capacitors," A. Jacques, *Bull. Sci. Ass. Ing. Elect. Montefiore*, No. 2, pp. 73–91, February, 1951, in French.

Parallel Transmission

Parallel lines are usually intended to increase the power transmitted and to reduce the transmission losses. While the first purpose will always be achieved, the second is not perhaps obtained in the same measure and sometimes the losses may even go up. There are, however, various methods of obtaining a sound compromise between the optimum conditions achievable in both respects. The first method consists in cutting-up the parallel system in one of the nodal points (only at the sending end practically possible) and regulating the current in the lines in the inverse ratio of their active resistances.

Another method uses a series reactor in the line with the smaller X/R ratio, or a regulating transformer to provide an auxiliary current suitable for assuring the optimum current distribution corresponding to minimum losses under any condition of operation. There is still a possibility of using two compensating transformers, the primary of each of which is connected in one of the lines, while their secondaries are cross-wise short-circuited. Their magnetic field then provides the required current compensation. The four methods mentioned are theoretically investigated in this paper, numerical examples concerning typical cases from transmission practice being calculated in full.—"Power Transmission by Parallel Lines," W. Erbacher, *Österreichische Zeitschr. f. Elektrizitätswirtschaft*, Vol. 4, No. 4, pp. 97–106, April, 1951, in German.

Cable Sheath Losses

The relationships governing the electromagnetic eddy field in each of the three cores of a symmetrical three-phase cable with a common lead sheath are derived under certain simplifying assumptions. The two adjacent cores considered are regarded as straight, quasi-linear conductors for purposes of this derivation. The eddy flow in the cores is derived from an auxiliary vector satisfying the wave equation, while the magnetic field outside the conductor is determined from a vector potential satisfying the Laplace equation. Current density and magnetic field inside the conductor depend not only on the distance of the point considered from the axis of the conductor, but also on the peripheral angle.

The distribution of the current density is discussed with reference to diagrams and the influence of the neighbouring cores on the asymmetrical current configuration is described. Active resistance and internal inductance of the cores are found as real and imaginary parts of a surface integral

of the complex Poynting vector. Approximation formulæ allowing for the losses and inductance of the lead sheath are derived. The principal design parameters of the symmetrical three-phase cable (active resistance), additional resistance and surface inductance are tabulated and the component effects are set out separately.

The surface parameters of 1 kV three-phase cable with different conductor sections are calculated from the formulæ derived. It is seen that the additional losses become appreciable only when the copper section exceeds about 120 mm². The percentage contribution of the residual loss components (own field of conductor, proximity effect, lead sheath) is determined and the reduction of the surface inductance with increasing copper section calculated. Lastly, the temperature relation of the current heat losses and the active resistance is investigated. A comprehensive bibliography is given.—" Active Resistance and Inductance of Three-phase Three-core Cables with a Common Lead Sheath," P. Jacottet, *A.S.E. Bull.*, Vol. 42, pp. 253–266, 21st April, 1951, in German.

Field Mapping

This article is a fairly detailed analysis of the problems solvable by the method of the electrolytic tank rather than a description of the latter, and for the good reason that the tank and the few auxiliaries it requires are simple. The mapping of fields by the electrolytic tank is done by a sonde method and it follows that when the sonde is made to travel about by mechanical means (on a carriage moving on rails of a frame which itself moves in a direction at right angles to the travel of the carriage) not only speed of operation is gained, but above all a co-ordinate system of reference and therefore precision of the measuring points on which the field map is based. The arrangement is, moreover, such that other " mechanical co-ordinate systems " are possible (e.g., polar ones) and a third movement in a vertical direction permits of three-dimensional " mapping."

The fields of application are manifold, to mention only the most important ones: dielectric and magnetic fields, hydrodynamical, filtration and diffusion fields, temperature and elastic fields and electrical networks. These general categories only outline what is practically an infinity of special, and important, problems such as electron optics, heat exchange, " air gap problems " in electrical machines, machining of metals, and purely mathematical problems in the solution of differential equations leading to harmonic functions.—" The Electrolytic Tank of the Centre of Studies on Electric Modelling (report on its Applications)," L. Dadda, *L'Energia Elettrica*, Vol. 28, No. 1, pp. 23–30, January, 1951, in Italian.

Switch Contacts

Silver has, apart from the best conductivity among all elements, other invaluable characteristics that make it the ideal contact material in the widest sense of the term. Although contacts and switch elements for diverse purposes may be subjected to stresses varying over a wide range, the stresses are basically always of the same kinds, mechanical, thermal and electrical stresses being the most important of them. There are also the dangers connected with oxidation. Where the latter are concerned, it is well known that the oxidation tendency of silver is quite insignificant, but it is not so well known that silver oxides, when formed, decompose at a temperature of only 200 deg C, which easily occurs in normal switch operation.

Switchgear design is partly complicated by the fact that oxidizable materials make it impossible to determine residual contact resistances with anything like the accuracy required. For silver this is no problem because, owing to the practical absence of any oxidation danger, the residual resistance does not vary. This makes a much higher current and thermal loading permissible for switches containing silver elements. A further advantage is that with silver there is much less consumption of the contact material by burning than with other contact materials, as the main loss occurs in the form of migration of material from one electrode to the other, which is recoverable.

The article gives examples of the correct design of silver switch elements for use in contactors, etc., and shows the relative wear of silver and copper elements in comparative pictures and diagrams.—" Silver in Switchgear Construction," H. Franken, *Der Elektrotechniker*, Vol. 1, pp. 73–77, September, 1949, in German.

Readers may arrange, by request, to obtain full translations of any of the articles abstracted above. —*Eds., Electrical Review.*

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1941

15611. Board of Trustees, Leland Stanford Junior University.—Electron-discharge apparatus. 3rd December, 1941. (656171.)

1946

29808. Vale, G. M.—Electrically-controlled system and automatic machine for repetition work. 18th September, 1947. (656172.)

1947

2482. British Thomson-Houston Co., Ltd.—Volume controlling amplifiers. 27th January, 1947. (656173.)

3280. Standard Telephones & Cables, Ltd.—Telephone systems. 4th February, 1947. (656132.)

5176. British Thomson-Houston Co., Ltd. (General Electric Co.).—Cathode-ray apparatus. 21st February, 1947. (656174.)

17006. British Thomson-Houston Co., Ltd., and Watts, B. N.—Manufacture of infra-red sensitive photo-cells. 7th December, 1948. (656176.)

19301. Igranic Electric Co., Ltd.—Multi-pole electric switches. 18th July, 1947. (656236.)

20136. Western Electric Co., Inc.—Transmission lines including directive pick-up devices. 25th July, 1947. (656237.)

21091. Sylvania Electric Products, Inc.—Electric glow discharge relay. 1st August, 1947. (656177.)

27158. Hoover, Ltd.—Suction cleaners. 9th October, 1947. (656180.)

28236. British Tabulating Machine Co., Ltd.—Electronic calculating machines. 22nd October, 1947. (656139.)

29980. Hoover, Ltd.—Suction cleaners. 11th November, 1947. (656181.)

33351. Smith Meters, Ltd., Charles, A., and Charles, J. A.—Prepayment meters. 17th December, 1948. (656183.)

34081. Sylvania Electric Products, Inc.—Machines for making radio tubes and like devices. 23rd December, 1947. (656148.)

34844. Staatsbedrijf der Posterijen Telegrafie en Telefonie.—Electrical signal receivers selectively responsive to different voltages. 30th December, 1947. (656184.)

35122. Standard Telephones & Cables, Ltd.—Multi-channel electric communication systems. 31st December, 1947. (656149.)

35125. Standard Telephones & Cables, Ltd.—Multi-channel pulse communication systems. 31st December, 1947. (656151.)

35326. Roseau, M.—Rotating transmitter for electro-mechanical power, in which the speed automatically varies as an inverse function of the variation of the resistance torque. 31st December, 1947. (656245.)

1948

4514. Maschinenfabrik Oerlikon.—Mercury arc rectifiers. 16th February, 1948. (656255.)

4615. Standard Telephones & Cables, Ltd., and Roe, F. O.—Arrangements for locating defective submerged repeaters. 11th February, 1949. (656188.)

4868. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Receiving circuits for telephony. 19th February, 1948. (656189.)

5086. Western Electric Co., Inc.—Automatic telephone systems. 20th February, 1948. (656190.)

5087. Western Electric Co., Inc.—Automatic telephone systems. 20th February, 1948. (656191.)

5712. Standard Telephones & Cables, Ltd.—Automatic facsimile transmitters and recorders. 26th February, 1948. (656258.)

7358. General Electric Co., Ltd., and Levy, M. M.—Cathode-ray tube distributors for use, for example, in multi-channel pulse signalling systems. 29th July, 1949. (656150.)

9304. Standard Telephones & Cables, Ltd.—Multi-channel electric pulse communication system. 2nd April, 1948. (656152.)

11709. Hadfield, B. M.—Electric signalling systems. 4th March, 1949. (656199.)

14400. Collard, J.—Radiating or receiving devices for electromagnetic waves. 6th May, 1949. (656200.)

14487. Igranic Electric Co., Ltd., and West, R. A.—Control systems for electric motors. 6th May, 1949. (656158.)

14892. General Electric Co., Ltd., Isaacs, G. G., and Nelson, E. H.—Arrangements for operating on d.c. high-pressure metal vapour electric discharge lamps. 20th May, 1949. (656201.)

16937. Denton-Ingham, H. W. (Lumalampen Aktiebolag).—Electric discharge tube. 23rd June, 1948. (656163.)

16996. Brush Development Co.—Means for and method of moistureproofing a piezo-electric crystal element. 24th June, 1948. (656164.)

18301. Marconi's Wireless Telegraph Co., Ltd., Brandon, P. S., and Dawson, L. H.—Radar systems. 22nd April, 1949. (656094.)

18702. Electronic & X-ray Applications, Ltd., and Tunnicliffe, E. A. J.—Drying apparatus. 12th August, 1949. (656271.)

19587. Glass, G., and Harper, B. I.—Poles for carrying telegraph, telephone or like aerial wires or cables. 22nd July, 1949. (656095.)

20000. Ilford, Ltd., Hercock, R. J., and Neale, D. M.—Electronic timing devices. 16th May, 1949. (656275.)

23717. Automatic Telephone & Electric Co., Ltd., and Rice, T. G.—Telephone or like systems. 31st August, 1949. (656281.)

23748. Radio Corporation of America.—Tuning indicator systems. 9th September, 1948. (656103.)

24275. British Thomson-Houston Co., Ltd.—Screens for cathode-ray tubes in colour television systems. 15th September, 1948. (656207.)

24785. Gilbert, T. J., and Davis, F. W.—Electric switches. 22nd September, 1949. (656104.)

25549. Hoke, L.—Dry cells for electric batteries and dry batteries consisting of such dry cells. 30th September, 1948. (656282.)

25763. Allam, P. S. (Fram Corporation). Quickly removable filter casing cover. 4th October, 1948. (656209.)

26014. Heenan & Froude, Ltd., and Walker, G. H.—Hydraulic dynamometers. 4th November, 1949. (656105.)

26253. Allmanna Svenska Elektriska Aktiebolaget.—Electric controlling systems for winding motors. 8th October, 1948. (656107.)

26339. Decca Record Co., Ltd., O'Brien, W. J., Bridges, D. E., Hendley, D. A., Easy, M. H., and Vickers, J.—Radio navigational systems. 7th October, 1949. (656108.)

26537. Stevens, A. H. (Research Corporation).—High-voltage electrostatic apparatus and method of operating same. 12th October 1948. (656212.)

26758. Westinghouse Brake & Signal Co., Ltd., Sheppard, E. A., and Stevens, S. A.—Illuminated signs. 18th August, 1949. (656213.)

27087. General Electric Co., Ltd., Smart, N. C., Chubb, A. A., and Mawson, R.—Automatic telephone systems. 16th August, 1949. (656214.)

28939. Chance Bros., Ltd., and Allison, A.—Dynamo-electric machines. 26th October, 1949. (656216.)

29135. Varley Dry Accumulators, Ltd., and Fuller, L.—Plate-type electrical secondary batteries. 31st October, 1949. (656111.)

31154. Radio Corporation of America.—Electrical generating apparatus. 1st December, 1948. (656114.)

33047. Telefonaktiebolaget L. M. Ericsson.—Automatic telephone systems. 22nd December, 1948. (656118.)

33095. Metropolitan-Vickers Electrical Co., Ltd., and Belsey, F. H.—Magnetic amplifiers. 14th December, 1949. (656120.)

1949

25730/7. Decca Record Co., Ltd., O'Brien, W. J., Bridges, D. E., Hendley, D. A., Easy, M. H., and Vickers, J.—Radio navigation systems (656123); Phase controlling circuits (656124); Crystal controlled oscillators (656125); Radio navigation systems (656126); Radio navigation systems (656127); Receiving apparatus for radio navigation systems (656128); Radio receiving apparatus (656129); Receiving apparatus for radio navigational systems. (656130.) (All 7th October, 1949, and divided out of 656108.)

1951

366. General Electric Co., Ltd., and Levy, M. M.—Cathode-ray tube distributors, for use, for example, in multi-channel pulse signalling systems. 29th July, 1949. (656170.)

Amended Specifications

592348. Raytheon Manufacturing Co.—Electron discharge devices.

614722. Kolster Brandes, Ltd., and others.—Variable inductances.

618522. Brown, N. H. B.—Means for mounting electrical components.

626067. List, H.—Kneading and mixing machines.

642825. Electric & Musical Industries, Ltd.—Scanning aerial equipment for radio distance-finding and like apparatus.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th July.

BEACON (design). No. 693,978, Class 7. Generators, electric motors (not for land vehicles), starters for motors (other than land vehicles), pumps included in Class 7, milking machines, and parts included in Class 7.—Workman, Reed & Co., Ltd., Beacon Works, Hewish, near Bristol.

Design. No. 691,948, Class 9. Parts included in Class 9 of scientific, electrical, signalling, etc., apparatus and instruments; and parts included in Class 9 of coin or counter freed apparatus, calculating machines, etc.—Bound Brook Bearings (G.B.), Ltd., Trent Valley Trading Estate, Lichfield.

LA VOIX DE SON MAITRE. No. 697,262, Class 9. Apparatus, instruments and devices for the recording, reproduction, transmission and reception of sound.—The Gramophone Co., Ltd., Blyth Road, Hayes, Middlesex.

HYGROSIL and HYGROLITH. Nos. 698,101–2, Class 9. Humidity indicating and measuring instruments.—Short & Mason, Ltd., Aneroid Works, MacDonald Road, London, E.17.

FLUOROSTAT and FLUOROSTATIC. Nos. B692,699–700. Fluorescent lighting apparatus and parts thereof, included in Class 11.—C.A.V., Ltd., Warple Way, London, W.3.

Swedish Electrical Trade

EXPORTS of electrical goods from Sweden last year continued the advance which had taken place between 1948 and 1949. Their value in 1950 was approximately 20 per cent more than in the previous year. From the accompanying statement it will be seen that the only noteworthy decline recorded was in accumulators. Outstanding destinations in 1950 for Swedish exports were Norway, Denmark, Finland, Poland, Brazil and the U.S.S.R.

EXPORTS

Class of Goods	1950 Kr. (000)	Inc. or dec. on 1949 Kr. (000)
Generators, motors, convertors, etc.	33,100	+ 5,220
Vacuum cleaners, fans, etc.	24,820	+ 5,470
Accumulators	16,440	— 560
Lamps	2,357	— 58
Starting, regulating, control and switch apparatus	14,280	+ 3,590
Cable, metal-clad	3,930	+ 110
Telegraph and telephone apparatus	46,400	+ 1,100
Radio apparatus and valves	17,400	+ 9,180
Electro-medical, etc., apparatus	5,250	+ 1,840
Special electrical apparatus, unspecified	30,570	+ 5,460

Sweden's import trade in electrical goods last year showed an advance of about 25 per cent in value on 1949. As will be seen from the accompanying table the only declines were in cable and wire, porcelain insulators and telegraph and telephone apparatus. Germany recovered business in certain lines. £1 = 14·50 Swedish Kr.

IMPORTS

Class of Goods	1950 Kr. (000)	Inc. or dec. on 1949 Kr. (000)
Generators, motors, convertors, etc.	33,310	+ 6,460
Vacuum cleaners, fans, etc.	17,507	+ 9,762
Stators, rotors, current collectors, etc.	3,960	+ 710
Accumulators	1,384	+ 34
Lamps, metal filament	5,470	+ 680
Lamps, mercury vapour, etc.	8,600	+ 4,780
Carbons for electro-tech. purposes	10,500	+ 3,300
Starting, regulating, control and switch apparatus	14,285	+ 1,978
Porcelain insulators	3,915	— 935
Cable, metal-clad	8,038	— 5,512
Cable, other	7,300	— 1,420
Electric stoves	738	+ 68
Telegraph and telephone apparatus	2,055	— 590
Radio apparatus	19,700	+ 670
Electro-medical, etc., apparatus	34,390	+ 13,195

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—SYDNEY.—16th August. County Council. Oil immersed current limiting reactors. C.R.E. (I.B.) 63936/51. Ten/2612.)*

MELBOURNE.—1st August. State Electricity Commission of Victoria. Eight 15 MVA transformers. (C.R.E. (I.B.) 64611/51. Ten/2645.)*

Belfast.—3rd August. Electricity Department. Lifting gantry, Victoria power station. (See this issue.)

Bolton.—18th July. Town Council. Street lighting. (See this issue.)

Canada.—TORONTO.—Transportation Commission. Date for submission of tenders for supervisory control equipment extended to 13th August. (C.R.E. (I.B.) 62089/51. Ten/2576A.)*

Dunbarton.—21st July. County Council. Street lighting columns. (See this issue.)

Epping.—24th July. U.D.C. Street lighting improvements. (See this issue.)

New Zealand.—AUCKLAND.—6th August. Auckland Electric Power Board. Submarine e.h.v. cable and accessories. (C.R.E. (I.B.) 63127/51. Ten/2581.)*

DUNEDIN.—15th February, 1952. Pumping plant, including electric motors and equipment for Musselburgh sewage station. (C.R.E. (I.B.) 63426/51. Ten/2605.)*

WELLINGTON.—11th September. State Hydro-Electric Department. Potential transformers for Tauranga and Waikino substations. (C.R.E. (I.B.) 64039/51. Ten/2616.)*

Nottingham.—23rd July. City Council. Concrete lighting columns and sodium lighting equipment. (See this issue.)

Pakistan.—13th July. Department of Supply and Development. Portable a.c. welding sets. (C.R.E. (I.B.) 64622/51. Ten/2643.)*

Rochdale.—17th July. Town Council. Electric lighting and power installations at the Passenger Transport Department workshops in Mellor Street. Borough surveyor, Town Hall.

South Africa.—CAPE TOWN.—14th August. Electricity Department. Street lighting fittings. (C.R.E. (I.B.) 64541/51. Ten/2637.)*

Southampton.—21st July. Borough Engineer and Surveyor. Electrical installations in 90 flats, Millbrook. (See this issue.)

Southport.—13th August. Lighting Dept. Class "A" sodium lighting in five roads and Class "B" filament-lamp lighting in thirty roads. (See this issue.)

Uruguay. — MONTEVIDEO. — 2nd August. Ferrocarril Central del Uruguay. Three-phase, underground 660 V cable. (C.R.E. (I.B.) 64025/51. Ten/2626.)*

Central Railway. 25th July. Incandescent electric lamps. 27th July. Fluorescent electric lamps. (C.R.E. (I.B.) 64023/51. Ten/2642.)*

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Grimsby.—Housing Committee. Electrical installations in Boulevard Avenue bungalows (£294).—Hobson and Scott, Sheffield.

Northampton.—Rural District Council. Electrical installation work in 96 houses in course of erection (£3,054).—S. & E. Electrical.

Romford.—Corporation. Electrical installation work in 114 houses and flats, Cross Road housing site (£2,468).—Mid-Essex Electrical Engineers, Chelmsford.

Swansea.—Housing Committeee. Electrical installations in New Street flats (£1,457).—Alpha Manufacturing & Electrical Co., Ltd., London.

Wigan.—Reorganization of electrical installation at Wigan & District Mining and Technical College (£7,750).—Frank Hancock, Ltd., Liverpool.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aspatria.—Fire station for Cumberland C.C.; county architect, 15, Portland Square, Carlisle.

Birmingham.—Dormitory block at Orphanage Road Fire Station, Erdington, for Fire Brigade Committee, and experimental blocks of non-traditional houses; H. J. Manzoni, city engineer, Civic Centre.

Brighton.—Flats (62), etc., Lewes Road; borough engineer.

Bristol.—Works, Brislington Trading Estate; Swift Cleaners (Bristol), Ltd., 65, Milk Street.

Cheadle (Cheshire).—Houses (400), Councillor Lane area, for U.D.C.; Taylor and Young, architects, 195, Oxford Road, Manchester.

Dorking.—Lecture hall block at National Fire Service College; James Longley & Co., Ltd., builders, East Park, Crawley.

Havant.—Primary school, Leigh Park; county architect, The Castle, Winchester.

Henley.—Council offices, Northfield End, for R.D.C.; T. Rayson, architect, 29 Beaumont Street, Oxford.

Hereford.—Extensions to factory for Ledbury Preserves, Ltd.; Foster & Dicksee, Ltd., Rugby.

Houghton-le-Spring.—Additions to Hawdonside confectionery works for William Wheatley & Son, Houghton-le-Spring.

Hounslow.—Six shops and eight flats, Hounslow West estate; borough surveyor.

Huddersfield.—Health centre on site fronting John Street; N. Nuttall, borough architect, High Street Buildings.

Immingham (Lincs).—Sulphuric acid works; National Titanium Pigments, Ltd., Battery Works, Stallingborough.

Kenilworth.—Houses (40), Bulkington estate; U.D.C. surveyor.

Kettering.—County fire brigade headquarters on site at the Headlands; county architect, County Offices, Northampton.

Lancaster.—Additional classrooms at Lancaster Skerton County School; Nicholson & Wright, Ltd., Willow Lane, Lancaster.

Liverpool.—Large new factory at Fleming Road, Speke, for Distillers Co. (Biochemicals), Ltd.; Yates, Cook and Darbyshire, architects, 43, Great Marlborough Street, London, W.1.

London.—BROCKLEY.—Flats and maisonnettes, Chudleigh Road and Merritt Road; Architect's Dept., New Scotland Yard, S.W.1.

CRICKLEWOOD.—Nurses' home at St. Andrew's Hospital, Dollis Hill Lane; E. H. Burgess, Ltd., builders, 34, Grosvenor Gardens, S.W.1.

POPLAR.—Flats and maisonnettes (104), Abbott Road; Farquharson and McMorran, architects, 14, North Audley Street, W.1.

SOUTHWARK.—Factory, Lavington Street; Nurdin & Peacock, Ltd., 59/65, Wells Street, W.1.

Maidstone.—Houses (136), Shepway Farm estate; borough surveyor.

Manchester.—Engineering works and canteen for Wm. Ayrton & Co., Ltd.; J. W. Beaumont & Son, architects, Danlee Buildings, Spring Gardens, Manchester.

Meriden.—Houses (64), Needlers End Lane, Balsall, for R.D.C.; P. B. Herbert, architect to Council, Grosvenor Buildings, Steelhouse Lane, Birmingham, 4.

Middlesbrough.—Primary school at Green Lane; Turner and Ing, quantity surveyors, 71, Linthorpe Road, Middlesbrough.

Newbury.—Houses (78), Thatcham, for R.D.C.; Eric G. V. Hives, architect, 3, Cork Street, Reading.

Newcastle-on-Tyne.—Factory, Foundry Lane, for S. Quinn & Son, bedding manufacturers; Newrick and Blackbell, 58, John Street, Sunderland.

Northampton.—Conversion of premises at The Drapery, as a restaurant; Architect's Department, J. Lyons & Co., Ltd., Cadby Hall, 141, Hammersmith Grove, London, W.14.

Nottingham.—Students' building at University; Cecil Howitt and Partners, architects, St. Andrew's House, Mansfield Road, Nottingham.

R.C. primary school, Kingsbury Drive, Aspley; Reynolds and Scott, architects, 9, Albert Square, Manchester.

Purfleet.—Office block; Thames Board Mills, Ltd., Unilever House, Blackfriars, E.C.4.

Reading.—Water depot, Berkeley Avenue (£43,500); G. F. Darlow, town clerk, Town Hall.

Ripon.—Twenty flats, North Road, for City Council; Steel and Owen, architects, 89, Albion Street, Leeds, 1.

Rotherham.—Extensions to police station for B.C.; Coe & Lorriman, Gerard Road, Rotherham.

Rothwell.—Houses (26), Lawrence Villa site, for U.D.C.; F. & C. Leach, Ltd., Park Lane, Pontefract.

Sheffield.—Secondary modern school, Richmond Road; Hadfield, Cawkwell and Davidson, architects, 279, Glossop Road.

Silsden.—Further houses adjoining Dradishaw site; U.D.C. surveyor.

Skegness.—Out-patients' and physiotherapy departments at District Hospital; Sheffield Regional Hospital Board, Fulwood House, Old Fulwood Road, Sheffield.

Smethwick.—Junior school, Halfords Lane (£85,000); Roland Fletcher, borough surveyor, Council House.

Stockport.—Re-development and extension scheme at Higher Hillgate Mills, for T. & J. Smith, Ltd.; Pierce & Son, architects, 30, St. Petersgate, Stockport.

Stretford.—Library reconstruction; Normantons, Ltd., Plymouth Grove, Manchester.

Sunderland.—Shipyard extensions for Bartram & Sons, Ltd.; J. G. Thompson & Sons, civil engineering contractors, 28, Fowler Street, South Shields.

Houses (226), Pennywell estate, for the T.C. Builders (all local firms): Stewart Brothers (24); Gordon Bell, Ltd. (24); George Henderson (90); and Wigham & Son (88).

Houses (576), Hylton Red House, for T.C. Builders (all local firms): Clerey & Son (90 houses); J. W. Ridley, Ltd. (24); G. H. Plemper, Ltd. (36); T. Stewart (52); T. D. Gibbons & Son, Ltd. (52); R. G. Finlay, Ltd. (92); J. Prentice (50); and L. W. Evans, Ltd. (180).

Taunton.—Extensions of laundry, Taunton & Somerset Hospital, East Reach, for Management Committee; Steer and Shirley Smith, architects, 1, Hammet Street, Taunton.

Torpoint.—Junior school (320 places), for Cornwall C.C.; S. Gregson, county architect, County Hall, Truro.

Weedon.—Factory for J. Sears & Co. (Trueform Boot Co., Ltd.), Stimpson Avenue, Northampton.

West Bromwich.—Extensions to works; George Salter & Co., Ltd., High Street.

Wisbech.—College of further education and technical institute, Ramoth Road (£80,000); R. D. Robson, county architect, County Hall, March, Cambs.